VOLUME 53 NUMBER 9 SEPTEMBER 1960

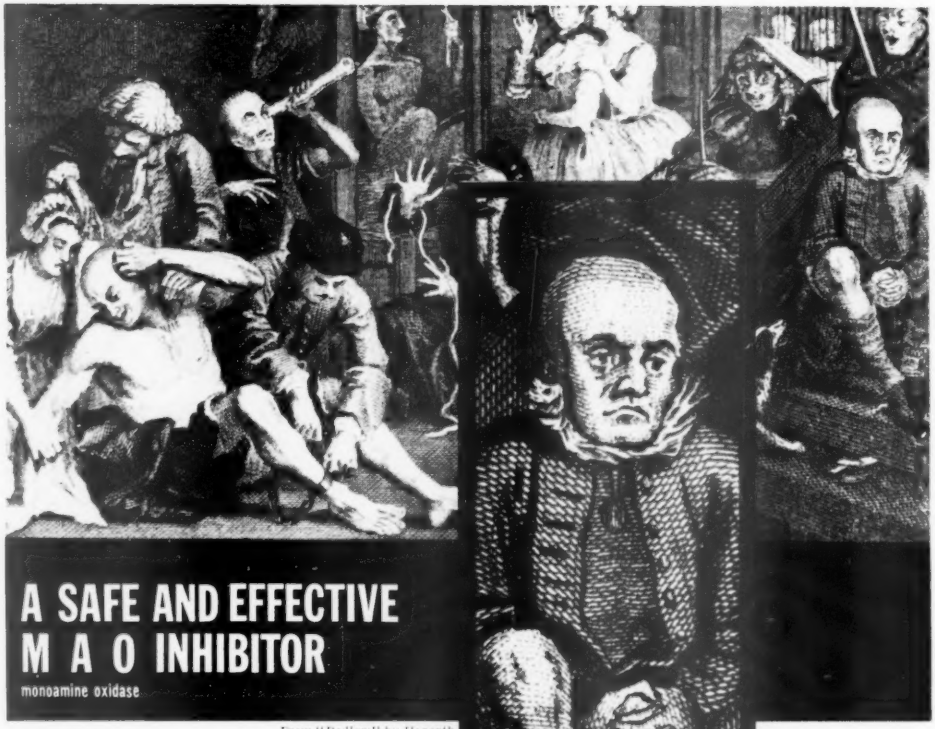
PROCEEDINGS

of the

ROYAL SOCIETY OF MEDICINE

Published by

THE ROYAL SOCIETY OF MEDICINE · 1 WIMPOLE STREET · LONDON · W 1



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ISSUED UNDER THE DIRECTION OF THE EDITORIAL COMMITTEE

All correspondence to
THE HONORARY EDITORS, 1, WIMPOLE STREET, LONDON, W.1
(Tel.: LANgham 2070)

Distributing Agents:
H. K. LEWIS & CO. LTD., 136, GOWER STREET, LONDON, W.C.1

In the U.S.A.:
GRUNE & STRATTON, INC., 381, FOURTH AVENUE, NEW YORK, 16

Advertisement Managers:
H. S. JANES & PARTNERS LTD., 99, GOWER STREET, LONDON, W.C.1
Telephone: EUSton 3221

Monthly, 10s. 6d. net. Annual Subscription, £6 6s. in the British Commonwealth $19.00 in the U.S.A.

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Vol. 53 No. 9 September 1960

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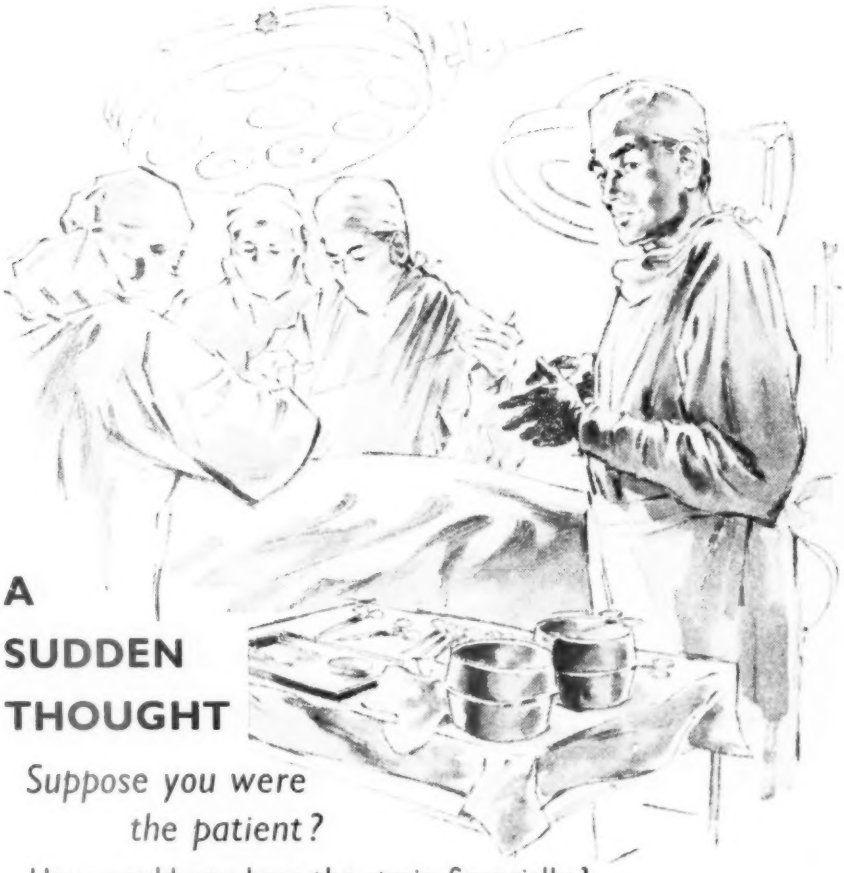

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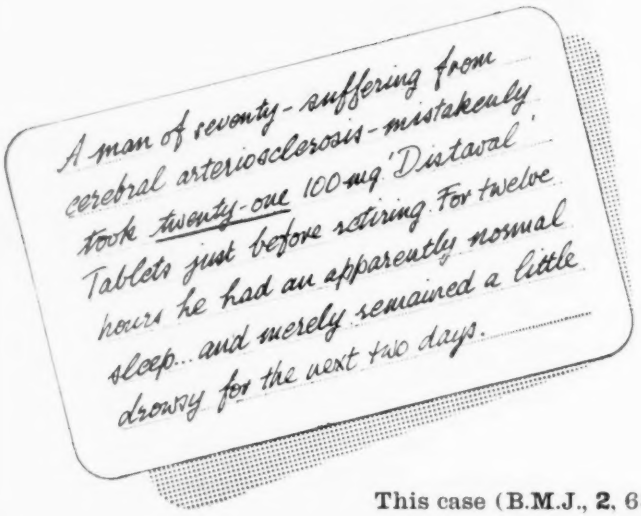

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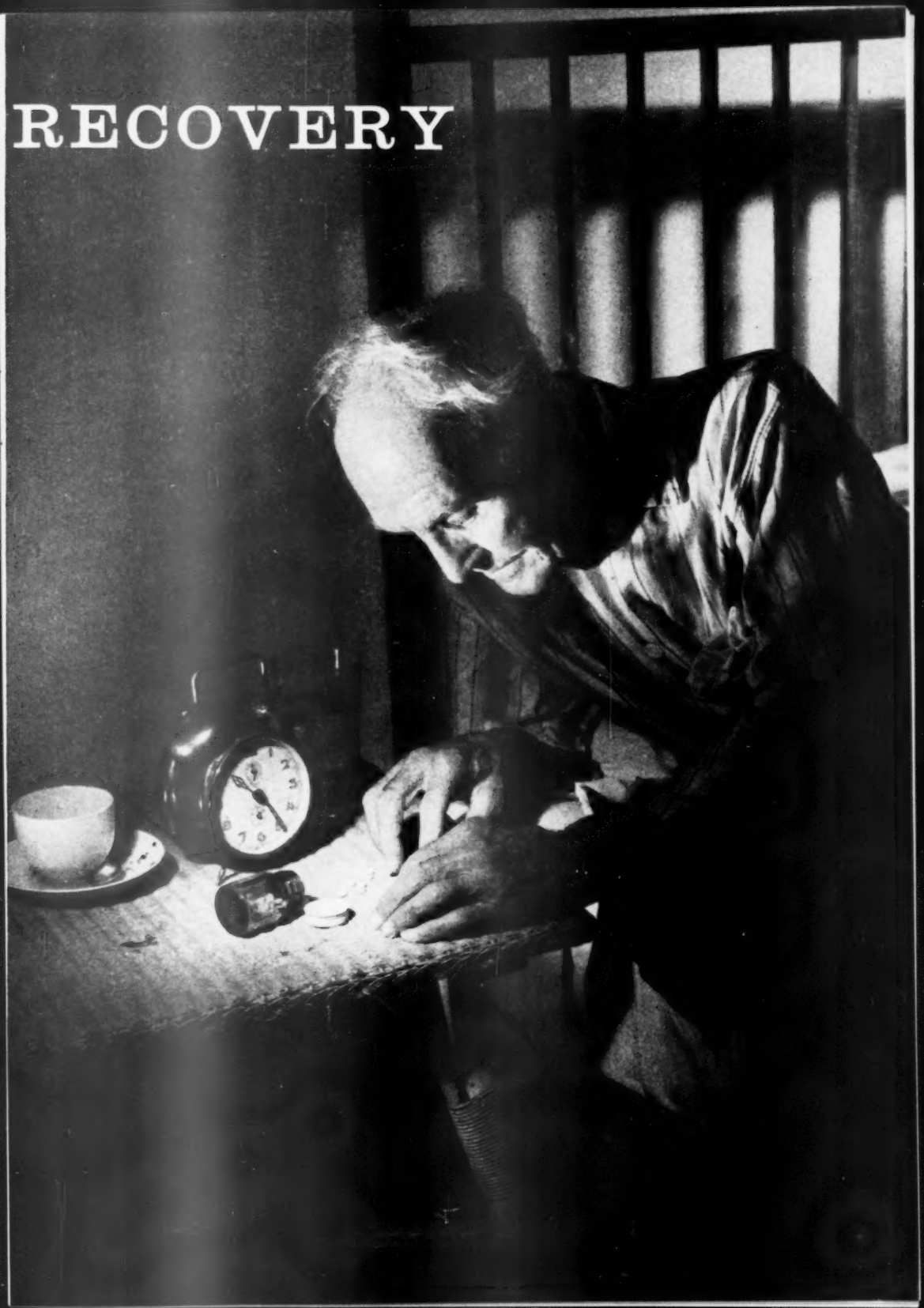
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Meeting
December 2, 1959

Professor IAN RICHMOND read a paper entitled **Roman Military Hospitals.**

Meeting
May 4, 1960

London Medical Societies in the Eighteenth Century

PRESIDENT'S ADDRESS

By CUTHBERT E. DUKES, O.B.E., M.D.

London

IN this Presidential Address I shall trace the sources of the group of Medical Societies which were formed in London during the eighteenth century. Of the 12 that I shall mention all but 4 have long ago ceased to exist. Our own Society has connexions with these historic medical societies because historians of the Royal Society of Medicine trace our descent back to the Medical and Chirurgical Society of London which was founded in 1805, itself an offshoot of a much earlier eighteenth century medical society. I shall explain later why this breakaway occurred, but first of all let us see what antecedents for those eighteenth century societies can be found even farther back in the past.

SEVENTEENTH CENTURY SCIENTIFIC SOCIETIES

Purely scientific societies are older than medical societies. During the seventeenth century several scientific societies were founded in Italy, France, Germany and England. Doctors often joined these, and though medical subjects were sometimes discussed they existed for the promotion of all branches of science. These seventeenth century scientific societies were almost all independent, voluntary associations receiving no organized support from universities or other established centres of learning (Ornstein, 1938).

In France at this time there were many private clubs or academies for the discussion of science and philosophy. These provided a forum for public debates and the free expression of opinion; before the seventeenth century such activities had often met with opposition from both civil and ecclesiastical authority (Brown, 1934). In Germany during the last quarter of the seventeenth century the Imperial Leopoldine Academy became an influential medical and scientific society and two famous doctors, Friedrich Hoffmann (1660–1742) and G. E. Stahl (1660–1734), were active members (Armytage, 1960).

In England we must pay tribute to the far-reaching influence of that pioneer association of scientists, founded in 1660, and incorporated in 1662 by Royal Charter as the Royal Society, whose founders had perceived that the best way to learn was by observation and experiment. They met solely to compare experiences, to demonstrate experiments, and to draw immediate deductions (Singer, 1928). During the early years physicians, surgeons, apothecaries and pharmacists were frequently elected as Fellows, and medical subjects were often discussed at the meetings of this most famous of all scientific societies, which proudly celebrates its tercentenary this year.

ANTECEDENT MEDICAL SOCIETIES IN SCOTLAND

In Britain the earliest purely medical societies were small groups of doctors who met for the purpose of collecting and publishing medical papers, and in this respect Edinburgh certainly set an example to London. Before the inauguration of any of the London medical societies Alexander Monro *primus* (1697–1767) was secretary of a medical group in Edinburgh which between 1732 and 1743 published 5 volumes of "Medical Essays and Observations". In 1783 this became the Royal Society of Edinburgh.

Of even more importance to the subsequent development of medical societies in London was the momentous decision in 1734 of six Edinburgh medical students to meet regularly once a fortnight as a discussion group. Each member in turn submitted a dissertation in English or Latin on some medical subject, which was then critically discussed by the other five members. Towards the end of 1737 this small group became constituted as the Medical Society of Edinburgh. Such was the lowly origin of what later became the Royal Medical Society, whose unbroken lineage continues to this day (Gray, 1952; Comrie, 1932). The objects of this youthful

Scottish society, as expressed by an early President, were "mutual improvement and the investigation of truth; the development of the seeds of genius, and the detection of falsehood; the emancipation of the mind from the fetters of prejudice, and the cultivation of true friendship by social and liberal intercourse".

In 1735 John Fothergill (1712–1780) joined this pioneer medical society whilst still a student and became an active member. His experience of the Students' Medical Society of Edinburgh convinced him of the value of such discussion groups and prompted him to initiate similar medical societies when a few years later he settled in practice in London. He took his degree of Doctor of Medicine at Edinburgh in 1736, after a short tour abroad, began to practise in London about 1740, and was the first graduate in Medicine of the University of Edinburgh to be admitted a Licentiate by the College of Physicians in London, an examination he took in 1744.

Fothergill was not the only member of the Edinburgh students' society to migrate to London and help establish medical societies here. I shall refer later to the influence of Alexander Russell (1715–1768), William Saunders (1743–1817), John Coakley Lettsom (1744–1813), Samuel Foart Simmons (1750–1813) and George Fordyce (1736–1802), all of whom were medical students in Edinburgh and afterwards took an active part in founding one or other of the eighteenth century medical societies in London. A former President of this Section, Sir Humphry Rolleston, noted that many Scottish medical societies, in spite of their serious pretensions, have preserved their convivial character, honouring their most respected members by conferring on them "graduate status" as "Doctors of Merriment" or "Doctors of Mirth and Social Joy" (Rolleston, 1930).

Function of Eighteenth Century Medical Societies

The primary purpose of most of the medical societies formed in London was educational, to provide a better medical education than was given by the older privileged licensing bodies (Power, 1939).

Dr. Newton Pitt, to whose writings I am much indebted, divided the eighteenth century medical societies into two classes, "those started by practitioners for the purpose of publishing cases, and those started by teachers as a means of keeping in touch with students and junior practitioners and of teaching them how to report and discuss cases" (Pitt, 1896). The possession of a library from which the members could borrow books was considered a very desirable feature. Medical societies thus came to supply some of the essentials of post-graduate education (Osler, 1903).

At this time the medical profession was sharply divided into three grades: physicians, surgeons and apothecaries. The training required for physicians and apothecaries has been fully described by a former President of this Section, Dr. Arnold Chaplin, in "Medicine in England in the Reign of George the Third"[1] (Chaplin, 1919), and the training and qualifications of surgeons by another former President, Sir Zachary Cope, in "The History of the Royal College of Surgeons of England" (Cope, 1959). I will only add that according to the Medical Register for 1783 London contained 149 physicians, 274 surgeons and 351 apothecaries. Apart from the medical societies, facilities for the further education of surgeons and apothecaries were almost non-existent, though there were meetings for physicians at the College of Physicians.

Eighteenth Century Medical Societies in London

Of all the independent cultural associations of medical practitioners established in London in the eighteenth century, satisfactory records exist for only 12, although there may have been other smaller groups of a more informal character. These 12 existed as voluntary associations of medical practitioners and something is known as to why each was formed and where they met.

1746—*The Society of Naval Surgeons*

The first eighteenth century London medical society of which we have records is the Society of Naval Surgeons, which first met at a private house in Covent Garden in 1746. It was intended primarily for physicians and surgeons of the Royal Navy of Great Britain, but membership was also open to "other doctors eminent in the Profession and of established character". It is interesting that this society was formed in the year following the separation of the Surgeons from the Barbers of London and the consequent formation of the independent Company of Surgeons, which soon appointed a Court of Examiners, one of whose functions was approving surgeons for the Navy.

The Society met on Wednesday evenings from 6 to 10 p.m. for discussion and lectures. There was an entrance fee of one guinea and an annual subscription of the same amount, but it was also stipulated that if any member had the good fortune to be given prize-money he should pay to the Society "One pound per cent" of all such money received!

In 1746 the Society engaged Samuel Sharp (*c.* 1700–1778) to deliver a course of lectures on the operations of surgery, but he soon handed over to William Hunter (1718–1783), then a young man of 28, who was so successful he was asked to extend his teaching to include anatomy. Hunter's popularity as a teacher was recorded by his nephew Matthew Baillie (1761–1823), who said "He excelled very much any lecturer whom I have ever heard in the clearness of his arrangement, the aptness of his illustrations and the elegance of his diction. He was perhaps the best teacher of anatomy that ever lived" (Munk, 1878, **2**, 210). There is no doubt that Hunter enjoyed teaching, for he said, "To acquire knowledge and to communicate it to others has been the pleasure, the business and the ambition of my life" (Finch, 1957).

The Society of Naval Surgeons was reorganized in 1750 and probably continued to exist until 1762 (Peachey, 1924).

1752—*The Society of Hospital Physicians*

When Dr. John Fothergill had been twelve years in practice in London he and a small group of physicians agreed to meet to exchange ideas and discuss prevalent diseases. This small select society never adopted a distinctive name but was simply called either the "Medical Society" or the "Society of Physicians". I will refer to it as the Society of Hospital Physicians to distinguish it from other groups which were formed later.

The advertisement of this Society, published in the *Medical Register* for 1783, says that it was instituted "to collect and publish medical observations and enquiries", but a clearer picture of its character was given by Lettsom (1783) in his preface to the "Works of John Fothergill". He says that "The persons who formed this Society were either such as had the care of hospitals, or were otherwise in some degree of repute in their profession. . . . When difficult cases occurred, the rest were consulted, and that method of cure, which appeared most likely to be attended with success, was tried, and the event communicated".

One reason for the formation of this society, and for the choice of Fothergill as its President, was an alarming epidemic in the winter of 1747–48 of what was called "Putrid Sore Throat". This may have been diphtheria or a severe form of scarlet fever, or a combination of both. Fothergill made a close study of the disease and wrote a small booklet about it criticizing the prevalent treatment of bleeding and purgatives and recommending instead what we would now call a "supportive regime". This original work at once established his reputation, and within a few years his practice was the most extensive and lucrative in London (Fox, 1919).

The meetings of this Medical Society were held on alternate Monday evenings at the Mitre Tavern in Fleet Street. It was essentially a select society and at one time consisted only of 7 physicians, 6 of whom were Fellows of the Royal Society. At Fothergill's suggestion (and probably at his expense), some of the papers which had been read before the Society were published in six volumes of *Medical Observations and Inquiries* between 1757 and 1784. The preface to the first volume states that "it is much to be regretted that the medical essays and observations of the Medical Society of Edinburgh have been discontinued, and it is hoped that the present may be in some degree considered as a continuation of that valuable work".

Fothergill was President of this Society at the time of his death, in 1780. After his death his friend Benjamin Franklin said of him, "If we may estimate the goodness of a man by his disposition to do good, and his constant endeavour and success in doing it, I can hardly conceive that a better man has ever existed" (Lettsom, 1783). Fothergill was succeeded as President by William Hunter, and it ceased to exist soon after Hunter's death in 1783.

There is a copy of the laws of this Society and a list of its members in the British Museum (Bailey, 1895).

1764—*The Society of Licentiate Physicians*

In 1764, twelve years after the Society of Hospital Physicians, a second "Medical Society" was formed in London, the membership of which was restricted to Licentiates of the College of Physicians. At first it had no distinctive name but it has come to be known as the Society of Licentiate Physicians.

The formation of this new medical society can be explained by the eighteenth century custom of the College of Physicians to elect to the Fellowship only those doctors who possessed the degree of Doctor of Medicine from the Universities of Oxford and Cambridge. This placed the control of the College almost exclusively in the hands of medical graduates of these two universities and Doctors of Medicine of other universities had no prospect of becoming Fellows or sharing in the counsels of the College. However, it would be wrong to suppose that the Society of Licentiate Physicians was entirely political in character: it had also an educational and social purpose. An entry in the *Medical Register* for 1783 says that the members met once a fortnight

on Wednesday evenings at Old Slaughter's Coffee House for the purpose of conversing on the prevailing diseases, and once a quarter dined at the Crown and Anchor Tavern in the Strand.

Dr. John Fothergill was elected President of this Society also in 1774 and held office for the remaining six years of his life. Another of the founder members was Dr. Alexander Russell, F.R.S. (1715–1768), a lifelong friend of Fothergill's who had recently returned to London after practising for fifteen years in Turkey. Russell and Fothergill had been fellow students at Edinburgh and members of the Students Medical Society (Gray, 1952).

Membership of the Society of Licentiate Physicians was of course limited to Licentiates and election was by ballot. Newton Pitt (1896) says that there were 23 members in 1783 but after this there are no further records and how long the Society lasted is not known.

1771—*Guy's Hospital Physical Society*

The Guy's Hospital Physical Society was formed in 1771 for the benefit of the staff and students of the United Hospitals, St. Thomas's and Guy's, which in those days were close neighbours. The preamble to the laws of the Society says that "Certain gentlemen desirous of improvement in medicine and other sciences nearly allied to it, and convinced of the numerous great advantages arising from a free communication of observations and opinions, have determined for that purpose to enter into an association, which they choose to distinguish by the name of the Physical Society". It soon established a place for itself in London medical life. Many of the early members had been pupils of John Hunter and in the Minute books there are references to his methods of treatment and his views on various questions. During the years 1783–1785, 168 ordinary members were elected and the attendance at meetings was often over 40.

William Saunders (1743–1817) was chosen as its first President. Saunders, like Fothergill and Russell, was an Edinburgh graduate (1765) and had been active in the Edinburgh Students Medical Society. In 1770 he had been elected as a physician to Guy's Hospital and began to lecture on the theory and practice of medicine. He was a good lecturer and a prolific writer. Dr. Richard Hunter (1960) tells me that he has evidence to show that Saunders was one of the first to distinguish delirium tremens from a miscellaneous group of febrile diseases. Saunders was subsequently elected President of the Medical and Chirurgical Society of London in 1805 and for this reason is listed as the first President of our Society.

In the early days of the Guy's Hospital Society the usual programme for an evening consisted of the reading of papers or reporting of individual cases, but sometimes set debates were arranged. For one evening in 1776 the subject chosen was "In what points of view should the human body be considered so as to speak of it intelligently yet consistent only with truth and reality?" In 1802 Jenner was invited to speak about vaccination. It is recorded that "On entering the theatre he was constantly received with universal and rapturous applause". So interested were the members that vaccination was discussed at four successive meetings. Jenner attended each one.

In 1830 the students at Guy's Hospital decided to form a medical society for students only, known as The Guy's Hospital Pupils' Physical Society, and the original society gradually faded out, ceasing to exist in 1852.

1771—*The Physico-Medical Society*

There are records in the British Museum of another medical society also founded in London in 1771 which was first called the Philosophico-Medical and later the Physico-Medical Society. It was founded by several medical gentlemen residing in London "for the purpose of submitting their respective opinions to the examination and correction of each other". This they arranged to do on Monday evenings from 7 to 9 p.m. and once a year dined together. The annual subscription was one guinea and arrangements were made for lending books. The place of meeting of this society and its duration are not known (Newton Pitt, 1896).

The only additional information is that in 1775 a proposal was made for the union of this society with the one formed in 1773 by Lettsom, which was then meeting in Crane Court, Fleet Street. Nothing official seems to have resulted from these overtures and the Physico-Medical Society may have faded out about this time.

1773—*Medical Society (Now The Medical Society of London)*

What is now known as "The Medical Society of London" was founded by Dr. John Coakley Lettsom in 1773. In the eighteenth century literature this Medical Society is often referred to either as the "Society in Crane Court, Fleet Street", where it met for the first fifteen years of its existence, or as "The Society in Bolt Court" which was its home from 1788 to 1850. The story of this famous society with its unbroken tradition, extending over a period of one hundred and eighty-seven years, has often been the theme of Presidential Addresses and Annual Orations,

all duly recorded in the *Transactions* of the Society and there is a great deal about its early history in Mr. Johnston Abraham's biography of Lettsom (1933).

Since the history of this Medical Society is so easily accessible I will limit myself only to two questions which have a bearing on eighteenth century medical societies in general. The first is the influence on Lettsom of his mentor and fellow-Quaker John Fothergill, and the second the reason why this society survived whilst others faded out.

John Coakley Lettsom (1744–1813) was born in the West Indies, educated in England and from the age of 16 to 21 was apprenticed to a surgeon and apothecary at Settle in Yorkshire. In 1766 he came to London with an introduction to Dr. John Fothergill. For the next two years Lettsom attended lectures at St. Thomas's Hospital and saw a great deal of Fothergill, to whom "he had access at all times" and with whom he breakfasted at least once a week. Then after a short visit to the West Indies, Lettsom attended lectures in Edinburgh for the winter session of 1768–9, and visited Paris and Leyden before finally settling in London in 1770, thus renewing once more his close association with Fothergill. Lettsom was only 29 when in 1773 he founded what is now the Medical Society of London. Fothergill did not join but he was then 61 years of age, very busy with his practice and an active member of two other medical societies, the Hospital and the Licentiate Physicians.

We now come to the question of why Lettsom's society has survived when so many other eighteenth century medical societies long ago ceased to exist. My own view is that this was due to three factors which gave the society a stability not possessed by some of its contemporaries. The first was its broad representative basis of membership. At one of its first meetings, on August 3, 1773, it was decided that the Council of the Society should consist of three physicians, three surgeons and three apothecaries and that at first the number of members should be limited to 30 physicians, 30 surgeons and 30 apothecaries. This was an important new principle: the recognition of professional equality both in membership and government. It raised the Society above the level of purely sectarian interest, both political and scientific. It was probably the first society to be constituted on what may be called a democratic basis, serving the scientific interests of the medical profession as a whole.

The two other factors responsible for its permanence were the possession of a good library and the ownership of its own premises. In 1787 Lettsom presented his munificent gift of the freehold of No. 3 Bolt Court, Fleet Street, a moment in the history of the Society which is commemorated by Medley's famous picture which hangs in the meeting room at 11 Chandos Street, W.1.

These three stabilizing factors assisted in the survival of the Society, but they did not render it immune from the youthful diseases to which all the eighteenth century medical societies were prone, namely internal dissensions within and hostile assaults from without. Historically these were quarrelsome times and the Society had its full share of stormy scenes, revolutions and counter-revolutions, which enliven and add spice even to the dull records of Council Minute books.

In the domestic tragedy of 1805 which resulted in the separation of the Medical and Chirurgical Society from its parent body, Dr. James Sims (1741–1820) has invariably been made the villain, but the character of this obstinate Irishman is due for a reappraisal (Dukes, 1960). In actual fact during the early years of his presidency Sims introduced order and confidence into the affairs of the Society and for many years it prospered under his leadership. His election to the Presidency in 1786 saved the Medical Society of London and his retention of the office for twenty-two years nearly shipwrecked it.

1774—*The Middlesex Hospital Medical Society*

In 1774, a year after the formation of the Medical Society of London, the students "walking" the Middlesex Hospital decided to form a Medical Society. They applied to the Court of Governors for permission to meet in the hospital, which was granted provided they paid a rental of three guineas a quarter and supplied their own candles! In the early years meetings were held two evenings a week for the discussion of clinical work. Though this Society has always been organised and conducted by students it has long been the custom to elect a member of the staff as President. This pioneer medical society has also continued to present times.

1779—*Great Queen Street Medical Society*

This society was started in 1779 by John Sheldon (1752–1808) in connexion with his Anatomical School in Great Queen Street.

At the age of 22, Sheldon succeeded William Hewson as a resident pupil in John Hunter's household and two years later was appointed

Lecturer in Anatomy at William Hunter's school. In 1777, when only 25, he opened his own school in Great Queen Street and this became the headquarters of the Medical Society which he initiated in 1779 and of which he was the first President. The Society met on Tuesday evenings at 7 o'clock from October to May. For the first hour medical news and cases were discussed, then a dissertation was read by one member and commented on by the President, paragraph by paragraph. The Society possessed a library and awarded a diploma to members who gave proof of medical ability and had written two dissertations.

Each year from one to three other members in addition to Sheldon were also elected as Presidents. Most of the members were practitioners, but there were also a few students. The membership fee was only one shilling and sixpence! In 1783 the Society consisted of 12 foreign and 17 honorary members, with 87 ordinary members. The Society did not last long and had probably ceased to exist before 1788 when Sheldon's health broke and he retired to Exeter, where he died in 1808.

We have recently been reminded by Mr. Norman Capener of the later years of this erratic genius in a contribution to this Section entitled "John Sheldon, F.R.S., and the Exeter Medical School" (Capener, 1959). This included also some further details concerning Sheldon's adventures in balloons and a reappraisal of the well-known story of the young lady whose body he preserved by embalming, and which his widow offered to the Royal College of Surgeons, where it remained until destroyed by enemy action in 1941. Our senior Honorary Secretary, Miss Jessie Dobson, has published an even more detailed account of Sheldon's medical career and literary activities, making special reference to his research work on lymphatics for which she thinks Sheldon deserves more credit than he has received (Dobson, 1954).

1782—*The Society for the Improvement of Medical Knowledge*

As already mentioned, the Medical Society founded by Lettsom in 1773 was the scene of many violent disputes during its early years. After one of these Dr. Samuel Foart Simmons, a former President, seceded with a number of his friends to form a new society in 1782 entitled "The Society for the Improvement of Medical Knowledge". The entry in the *Medical Register* for the following year says that the Society was formed for the purpose of collecting useful essays and observations for publication. Meetings were held once a fortnight on Tuesday evening at Old Slaughter's Coffee House and the members dined together once a quarter. The Society probably lasted only a year or two.

Samuel Foart Simmons (1750–1813) deserves to be remembered. Though born in England he was educated in France, studied medicine for three years in Edinburgh, then made an extensive postgraduate tour on the continent and finally in 1778 settled in practice in London. For many years Foart Simmons was the sole editor of the *London Medical Journal* and of *Medical Facts and Observations*. He was also the originator and compiler of the *Medical Register*, the prototype of the present day *Medical Directory*, three volumes of which were issued, dated 1779, 1780 and 1783. Later he specialized in the treatment of the insane and in 1803 attended George III during a lapse into insanity.

1783—*The Society for the Improvement of Medical and Chirurgical Knowledge*

In 1783 another society was started with a similar name, "The Society for the Improvement of Medical and Chirurgical Knowledge". John Hunter and George Fordyce took the lead in this society, which possibly was an expansion of that founded by Foart Simmons the previous year, having the same place of meeting.

This medical society was a select group consisting originally of only 9 members with power to increase up to 12 but not beyond. Membership was restricted to physicians or surgeons of five years' standing or those already on the staff of St. Bartholomew's, St. George's, Guy's or St. Thomas's Hospitals. For the first ten years it was not responsible for any publications but between 1793 and 1812 issued three volumes of *Transactions*. After this the Society continued merely as a dining club of ten survivors who met once a month, and ended in 1818.

George Fordyce (1736–1802), one of the prime movers in the initiation of this Society, was a convivial Scot who studied at Aberdeen and Edinburgh and came to London in 1758 to work with William Hunter. He soon became more interested in chemistry than in anatomy and in 1764 began to lecture in Chemistry, Materia Medica and the Practice of Physic, continuing to teach these three subjects for nearly thirty years. The reference to him in Munk's Roll (1878, **2**, 374) says that he had always been fond of society, and so as "to render the enjoyment of its pleasures compatible with his professional pursuits, he used to sleep but little". He had even been known to lecture for three consecutive hours in the morning from 7 to 10 a.m. without having

undressed himself from the preceding night! He eventually succumbed to gout and died at his home in Essex Street, Strand, in 1802.

1785—*Lyceum Medicum Londinense*

In 1785 John Hunter and George Fordyce were again associated in the foundation of a medical society, the famous "Lyceum Medicum Londinense". It might be described as John Hunter's Society because it met in the central suite of his rambling establishment which stretched from his great house in Leicester Square on to what is now Charing Cross Road. It first began as a sort of medical conversazione on Sunday evenings when Hunter's medical friends were entertained with tea and coffee and discourses on "Medical Occurrences", but later on meetings were held on Friday evenings from 8.30 to 11 p.m. from October to May. It is of special interest that there were three classes of ordinary membership: (1) Those who had taken a qualification or were already in practice, of whom there were eventually 78; (2) students who had attended a hospital and one course of lectures on anatomy and the practice of Physic, 314 members; and (3) students commencing their studies, of whom there were only 7.

Those belonging to the first two categories were required in turn to read a dissertation which was discussed the following week. The Society presented annually a gold medal for the best dissertation on a set subject. The entrance fee was one guinea and fines were inflicted on a member who left a meeting without publicly standing up and asking permission to do so! All cases read before the Society were entered in a Minute book and a committee was appointed to examine them, with power to send such as they thought proper to Dr. Simmons to be published in his *Medical Facts and Observations*. The Society accumulated a library for use of its members. It is obvious that this Society was an educational as well as a social centre. It lasted about twenty years and in 1809 its remaining members were transferred to the Westminster Medical Society, one of the professed objects of which was to promote intercourse between medical students and teachers.

John Hunter (1728–1793) was certainly the founder of this Society but his influence can be traced in two of the other eighteenth century medical societies in London, "The Society for the Improvement of Medical and Chirurgical Knowledge" in 1783, and the Guy's Hospital Physical Society, many of the early members of which had been his pupils.

John Hunter was an impatient man, blunt and unceremonious, often rude and always candid. He said some hard things about "medical tea-sipping societies". In company he was often taciturn, yet when he spoke his words were well chosen, forcible and pointed, and often coarsely humorous! Dr. Abernethy, in delivering the first Hunterian Oration in 1819 said of him—"Those who far precede others must necessarily remain alone; and their actions often appear unaccountable, nay even extravagant, to their distant followers, who know not the causes that gave rise to them, or the effects that they were designed to produce. In such a situation stood John Hunter with relation to his contemporaries. It was a comfortless precedence, for it deprived him of sympathy and social co-operation" (Peachey, 1924).

1795—*The Abernethian Society*

What is now "The Abernethian Society" at St. Bartholomew's Hospital first existed in 1795, as "The Medical and Philosophical Society". It was intended primarily for students who paid a small weekly subscription, but the medical and surgical staff also supported it by the presentation of books for the library. In the early years Dr. Abernethy himself was a regular attender but after his death in 1827 the Society languished and the library was handed over to the Medical School. In 1832 this Society took a new lease of life and was reconstituted under its present name.

John Abernethy (1764–1831) began to give courses of lectures soon after his appointment as assistant surgeon to St. Bartholomew's Hospital in 1787, and his success was one of the factors which induced the Governors of St. Bartholomew's Hospital to build a lecture theatre there in 1791. Abernethy was notorious for his blunt independence and rudeness of manners but equally famous as an excellent teacher. Sir Benjamin Brodie wrote, "He kept our attention so that it never flagged: and that which he told us could not be forgotten. He did not tell us so much as other lecturers but what he did he told us well" (D.N.B., 1885).

Epilogue

Only 6 of the 12 medical societies founded in London in the eighteenth century survived until 1800 and by 1810 these were reduced to 4—the Guy's Hospital Physical Society, the Medical Society of London, the Middlesex Hospital Students' Society and the Abernethian Society, all of which continue to this day. 5 more similar medical societies were formed in London in the nineteenth century—the Hunterian Society in 1819, the Harveian Society of London in 1831, King's College Medical and Scientific Society in 1833 (now the Listerian Society), the West

London Medico-Chirurgical Society in 1882 and the Chelsea Clinical Society in 1897. Several medical societies, limited to the specialties of medicine, were also founded in London during the nineteenth century and it was the federation of 17 of these with the Royal Medical and Chirurgical Society which brought into existence the Royal Society of Medicine in 1907.

The History of Medicine Section of the Royal Society of Medicine was established in 1912 with Sir William Osler as its first president. At the first meeting Osler described himself with characteristic modesty as "an amateur student who dabbled in history as a pastime!", and hoped that the Section would provide a meeting ground for both scholars and students and for all those who felt that a study of the history of medicine had a value in education.

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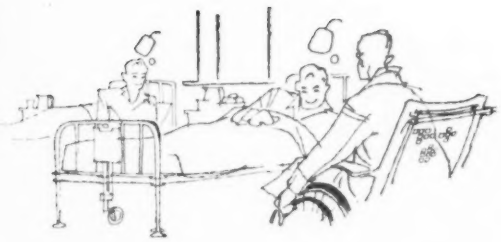
Meeting
June 1, 1960

Mr. JAMES KEMBLE read a paper entitled **Napoleon—A Man Condemned to Live.** This included new material upon the medical life of the Emperor and an amplification of some of the clinical history referred to in the recently published book "Napoleon Immortal", by James Kemble (London, 1959).



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Section of Physical Medicine

President—BASIL KIERNANDER, M.R.C.P.

Meeting
March 9, 1960

SAMUEL HYDE MEMORIAL LECTURE
[Number 14]

Progress and Problems in the Rehabilitation of Disabled People [*Abridged*]

By F. S. COOKSEY, O.B.E., M.D., F.R.C.P.

THE past two decades have seen a great deal of progress in many aspects of the rehabilitation of disabled people and complex services have been established to provide the requisite facilities. The outstanding problem at the present time is how to achieve the speedy integration of these services in the management of individual patients.

Early in the Second World War facilities were established for the rehabilitation of Service and civilian casualties following the pattern developed by Robert Jones in the latter part of the First World War. For the first time, facilities for comprehensive rehabilitation were tried out in all types of sickness and injury, including the chronic sick and elderly infirm, with invariably encouraging results. The success of the war-time centres soon led to public and professional recognition that rehabilitation should become an integral feature of clinical practice and the allied social services. Consequently, comprehensive provisions for rehabilitation were included in the various Acts of Parliament which reconstructed the social services in the latter part of the Second World War and the years immediately following.

Although the statutory provisions for rehabilitation are still virtually complete, there is, nevertheless, a fundamental weakness in the legislation in that it divides the responsibility for the rehabilitation of the individual patient between several Government departments, and often even within a department. To counteract this weakness various arrangements have been made between the departments for the co-ordination of these services at central and local administrative levels, primarily to achieve integration at the level of the individual patient under the supervision of his general practitioner.

Divided Responsibility for Patients

In practice these arrangements do not work as well as was hoped, because management of the patient has been divided into physical, mental, social, vocational and economic components and each is further subdivided. Responsibility for the patient involves many people who do not meet the general practitioner or each other and often do not even see the patient. This division of responsibility may slow up the whole process of treatment and rehabilitation. Those concerned include general practitioners, specialists including psychiatrists in hospital and at medical rehabilitation centres, industrial medical officers, medical officers of industrial rehabilitation units and vocational training centres, medical officers of health for domiciliary rehabilitation including re-housing, medical officers at regional appliance centres, medical officers of insurance companies, regional medical officers dealing with claims for sickness benefit and pensions and school medical officers when children are involved. To the doctors must be added the para-medical personnel and the technical officers of the Ministries of Education, Health, Labour, Pensions and National Insurance.

In hospitals there can be a lack of co-ordination between departments unless they are brought together through the medium of case conferences. Even more difficulty is encountered in integrating the various extra-mural services. A surprising number of people may be concerned in geographically separate places which patients or their relatives have to visit. Direct consultation is uncommon and communication is by certificate, letter, telephone or even messages sent through patients and relatives.

In some central and local Government departments there is no direct medical responsibility for certain aspects of rehabilitation and, although medical advice is usually sought, it is not necessarily acted upon nor are the reasons given unless specially requested.

It has been suggested that a single Government department should be responsible for all aspects of the rehabilitation and resettlement of disabled people, but, as the Piercy Committee (1956) indicated, this is not the answer to the problem of co-ordination. Medical rehabilitation cannot be divorced from other aspects of medical care, nor can the education, employment and social security of disabled people be separated from the wider aspects of education, employment and national insurance.

The Scope of Rehabilitation

There are two distinct and yet closely interwoven aspects of rehabilitation. The first is directed towards helping people who are substantially and permanently disabled to make the best use of their residual capacity and to lead normal lives. The motive here is primarily humanitarian but experience has shown that there are also substantial economic advantages.

The second aspect of rehabilitation is concerned with counteracting the various side-effects of sickness and injury which may cause unnecessary disability and prolong convalescence even though the primary pathological disorders resolve completely. Here again, the motive is humanitarian; but the economic factor is also of great importance because it applies to a large number of sick and injured people and not only to the few who are permanently disabled.

The Size of the Problem

Although there has been general agreement for many years on the need for systematic measures to rehabilitate the disabled there are still very few reliable figures as to the magnitude of the problem and the clinical, social and economic value of rehabilitation. A Committee of the British Medical Association (1954), the Piercy Committee (1956), and an Expert Committee of the World Health Organization (1958) all drew attention to the lack of reliable information, except concerning some limited and selected categories of disabled people.

This lack of statistical information after twenty years of development in this field is deplorable, but there are extenuating circumstances. In the first place, it is very difficult to obtain accurate information because so many variable factors, medical, psychological, social, vocational and economic, affect the need for rehabilitation and the response to it. Secondly, in this expanding field the supply of trained personnel has lagged far behind the demand and very few people with the requisite expert knowledge have had the time or personnel at their disposal to conduct critical investigations. Thirdly, national statistics of morbidity and claims to social security benefits are in terms of pathological disorders and they are useless for determining the extent of functional incapacity under varying social circumstances.

Investigations of this nature cannot be carried out on a national basis except at prohibitive expense. The only practical way is to work out suitable methods by studies in typical parts of the field and to test their validity by pilot experiments.

Resettlement Clinics

The need to integrate the medical and industrial aspects of rehabilitation became apparent soon after the passing of the Disabled Persons (Employment) Act, 1944, and led to the setting up of Medical Interviewing Committees about 1946. These Committees were based at selected hospitals in industrial areas and brought together an industrial medical officer, an almoner, a disablement resettlement officer (D.R.O.) and a member of the hospital medical staff who acted as chairman. Their purpose was to advise the disablement resettlement officer concerning unemployed disabled persons attending the local employment exchange.

It was soon found more advantageous to effect liaison during treatment of the disabling illness, and about 1947 some hospitals began to establish informal case conferences, the so-called resettlement clinics. A few years later the need to establish liaison with the developing local health and welfare services led to arrangements with the Local Authorities for the local health visitor and welfare officer to attend the resettlement clinics (Cooksey, 1954).

Resettlement clinics are held once or twice a month at King's College Hospital and each year the industrial resettlement of about 45 patients and the social resettlement of about 25 patients have been considered. The types of cases have been fairly consistent and two previous follow-ups have been undertaken to find what proportion of patients succeed in obtaining and holding suitable employment. In January 1960 a further follow-up was done of the patients seen in the industrial resettlement clinics in 1957 and 1958 to investigate the time interval between patients being assessed as fit for work or industrial rehabilitation and their obtaining suitable employment (Table I).

TABLE I.—INDUSTRIAL RESETTLEMENT CLINIC
Cases seen in 1957 and 1958

	Clinic advice	Action taken	Follow up 1960
Direct placement in work ..	36		
Work found by patient ..		7	6
Work found by D.R.O. ..		25	34
Industrial Rehabilitation Unit	23	16	
Government Training Centre ..	5	10	
Sheltered work	8	6	6
Waiting for sheltered work ..		2	2
Not working at follow up ..			6
Unemployable	10	15	21
Dead		1	2
Unknown			5
Total cases	82	82	82

Only two-thirds of the patients assessed as being capable of open or sheltered employment were working one to three years later. In some cases this was due to physical and mental deterioration, but a larger number were written off as unemployable because of failure to obtain or hold work in open industry and for whom

sheltered work was not available. The longer disabled patients have to wait for suitable work the poorer are their prospects of obtaining it because they become conditioned to managing on social security benefits, lose self-confidence and hesitate to tackle a job unless it is fairly attractive. In time these patients become labelled as inadequate and work-shy personalities, but in most cases this would not occur were work available soon after they had been medically rehabilitated.

23 of the 36 patients assessed by the resettlement clinic as being fit and ready for direct placement in work had regular work at the time of follow-up but had taken an average of nine weeks to find it. Half the patients obtained work within a month and the remainder averaged sixteen weeks. Although it is generally considered that older patients have greater difficulty in obtaining work, our figures do not suggest this as a major difficulty.

14 of 16 cases recommended by the resettlement clinic for admission to industrial rehabilitation units (I.R.U.) did not enter for an average of 8·5 weeks. This is due to cumulative delays in the various procedures involved in transferring a patient from medical to industrial rehabilitation. After the decision of the resettlement clinic, in agreement with a D.R.O. from the employment exchange nearest the hospital, that a patient be recommended for admission to an I.R.U., a doctor must complete form D.P.1 which is then sent to the almoner dealing with any concurrent social problem, and finally to the D.R.O. at the patient's local employment exchange, who is not necessarily the D.R.O. present at the conference. The patient's previous employment record and the D.P.1 are then passed to the appropriate I.R.U. where the final decision is made, except in doubtful cases which are referred to regional headquarters. When a patient has been accepted there is a further wait of one to six weeks for a vacancy.

7 of these 14 cases took an average of eleven weeks to find work after leaving the I.R.U. and there were 2 more, assessed as being employable, who have never found work. On the other hand, 5 cases that went on from the I.R.U. to vocational training only averaged one week to find work after leaving the Government Training Centre. A fifteenth case, a youth of 19 with cerebral palsy, was excluded because the thirty-six weeks' wait to enter the I.R.U. was so much in excess of the mean of the series. Nevertheless, a further thirty-six weeks after leaving the I.R.U., this youth was placed in a Remploy factory and he is still doing satisfactory work. Thus, he was placed one year and five months after the resettlement clinic thought he was ready for industrial rehabilitation.

The Need for Transitional Workshops

Even short delays are demoralizing for patients who have been brought to the pitch of being fit and willing to work or to move on to industrial rehabilitation units. Substantial, though generally shorter, delays also occur in the management of many convalescent patients and not only in the more severely disabled. There is a need to provide remunerative work within easy access of all major hospitals in workshops which would act as holding centres from the moment patients were considered fit for work until suitable jobs could be found or a vacancy became available in an industrial rehabilitation unit or training centre.

These workshops might be run by the Ministry of Labour and undertake sub-contract work for local industry. They would be simple workshops without the industrial and social assessment facilities of the I.R.U.s; but the I.R.U.s should still be available for the relatively small number of patients who require full assessment and industrial re-conditioning. Patients should be paid the same training rates as in the I.R.U.s thus maintaining the incentive to return to open industry as soon as possible.

The Importance of Early Functional Assessment

Further delays can occur in the discharge of elderly patients from the wards to their homes, particularly with cases of hemiplegia and fractures of the femoral neck. At King's College Hospital although full facilities for rehabilitation were available, it was found they were being brought into operation consecutively instead of concurrently. Physiotherapists taught the patient to walk with crutches or sticks, but it was often not until he was nearly ready for discharge that serious social obstacles were discovered, such as living alone or with a frail spouse, living in an upstairs flat with perhaps more stairs to climb to the only toilet, inconvenient or dangerous kitchen equipment and so on.

Accordingly, the patient is now seen soon after admission to evaluate any social problems in relation to his probable functional capacity on discharge from hospital. In the majority of cases only an interview with the patient or relatives was necessary, but in some, particularly elderly patients living alone, the occupational therapist or physiotherapist visited the patient's home. Strictly, the local health visitor should report on the home situation, but it is the occupational therapists and physiotherapists who are best equipped to assess the physical conditions with which the patient will have to contend when he returns home.

Physiotherapy treatment cubicles are now used to provide a replica of the type of toilet, bathroom, living room and stairs found in the majority of

patients' homes. This section of the department, known as the functional assessment unit, is in the joint charge of an occupational therapist and a physiotherapist and has proved most successful.

Once a week the medical staff meet the almoners, occupational therapists and physiotherapists when the initial functional assessment of the patient suggests that there are likely to be special difficulties. These case conferences have largely, but not entirely, replaced the industrial and social resettlement clinics; many of the problems that formerly did not materialize until the patient attended a resettlement clinic are now identified and dealt with at an earlier stage. Nevertheless, resettlement clinics are still held because they are useful in bringing together the personnel of medical, social and industrial rehabilitation thus facilitating future liaison by telephone and correspondence when dealing with routine cases.

TABLE II.—FUNCTIONAL ASSESSMENT UNIT. MARCH 1958 TO FEBRUARY 1960

Fractures of femoral neck	74
Other fractures (mainly lower limb)	51
Amputees (mainly lower limb)	35
Hip arthroplasty	19
Hip arthrodesis	14
Osteoarthritis of hip	43
Generalized osteoarthritis	22
Rheumatoid arthritis	50
Hemiplegia	54
Disseminated sclerosis	25
Other disorders of C.N.S.	38
Miscellaneous	39
Total	464

Table II shows the type of cases that have been through the functional assessment unit in the past two years. The high incidence of disorders of the central nervous system is notable; and the somewhat fewer surgical than medical cases, indicative of the increasing attention paid to the rehabilitation of medical disorders in recent years.

43 of 74 patients with fractures of the femoral neck returned home to relatives and 18 returned home to live alone. All were independent of help, using only a single tripod stick when discharged after an average hospital stay of five weeks. Those who had to climb stairs were trained to do so and, when required, an additional handrail was fitted. This rapid and virtually complete rehabilitation has been possible in the last two years when orthopædic surgeons allowed pinned intracapsular fractures to start partial weight-bearing at ten days. The remaining 13 cases had to be transferred to half-way houses or Part III accommodation but in every instance there was a complicating factor such as hemiplegia, Parkinson's disorder, mental confusion, and so on. The average age of all cases was 76 years.

Integration by Concentration of Services

The following is a long-term plan which could effect integration of treatment and rehabilitation without altering the existing structure and administration of the health and allied social services.

Most of the necessary services are represented in every sizable community but they are often geographically widely separated with no common meeting ground for the personnel concerned. The main general hospital of a district could become the medico-social centre of the area by the addition of accommodation for as many of the other services as possible, including a common record department. Each department would keep its own full working notes because these are not always ready or suitable for general circulation, but the essential clinical details and the prescription of treatment and other services would be entered on common records.

A suite of consulting rooms with receptionists and secretaries should be available for use by all general practitioners in the district. The general practitioner could then see any of his patients who were in-patients or attending as out-patients and most important he would have access to the common records and the hospital personnel supervising the care of his patients. In this way the general practitioner would come much nearer to fulfilling his proper role as the primary medical adviser and ultimate co-ordinator of all aspects of treatment and rehabilitation.

Local health and welfare clinics would be located at the medico-social centre, although some maternity and child welfare, school and chiropody clinics would be needed at the periphery of the district for easy access by patients. The senior health visitor and senior welfare officer of the district should have offices at the centre from which they can organize the domiciliary midwifery, nursing, domestic help and welfare services. Offices for use by representatives of the local voluntary services would facilitate co-ordination with the statutory services. The local housing officer and ambulance services should also be based at the centre. A dispensary common to all the clinics at the centre would help to eliminate duplicate prescribing of drugs. It might be combined with a central store for the loan of crutches, wheel chairs, home nursing equipment and welfare aids, and provide facilities for the fitting and supply of medical and surgical appliances.

The disablement resettlement officer should have an office at the medico-social centre to facilitate consultation with hospital personnel and general practitioners. A further advantage would be an industrial rehabilitation workshop, run by

the Ministry of Labour, to act as a holding centre for patients as soon as they become fit for work and are awaiting suitable vacancies in local industry or admission to training centres. A medical and technical officer from the regional appliance centre and possibly from the regional limb-fitting centre should have consulting rooms and facilities for testing patients in the use of the more common appliances. Whilst these specialized services have to be regionalized, a great deal of correspondence, travelling by patients and incorrect prescription would be saved if the expert personnel of these services were available for regular consultation at the centres where the greatest demand is concentrated. The National Assistance Board has offices in every district. One of these could also be at the medico-social centre and might include consulting rooms for the regional medical officers of the Ministry of Health. Like general practitioners' surgeries and local authority clinics, National Assistance offices would also be needed at the periphery of the district.

At first sight this proposal of a medico-social centre may seem unworkable in London and in large cities where there are so many hospitals, general practitioners and local authority services. Nevertheless, the National Health Service has already brought about a more even spread of services and the majority of patients are dealt with in their own districts, so that integration should not be difficult to achieve. Now that a major programme for the rebuilding of hospitals has been started there is opportunity to combine all medical and allied social services of a district. The hospitals are by far the most expensive buildings and the advantage of adding the modest accommodation for the clinics and offices required by the other services should far outweigh the cost. Some provision for the integration of services is being made in the new towns but not to any extent in the large old cities where the need is numerically greater.

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Meeting
April 13, 1960

CONGENITAL ABNORMALITIES, IN PARTICULAR RELATION TO DISORDERS OF THE LOCOMOTOR SYSTEM

Dr. D. H. M. Woollam and **Dr. J. W. Millen** (Cambridge):

Environmental Factors in the Ætiology of the Congenital Malformations

Whether the differentiation and growth of the embryo proceeds normally to term and results in the birth of a live healthy child, or whether the embryo aborts, dies *in utero* and is resorbed, is stillborn, or born alive but deformed, depends on a complex of factors, both hereditary and environmental. Until comparatively recently, prominence was given almost exclusively to genetic factors, and it was thought that eventually the ætiology of congenital malformation would be elucidated upon a genetic basis.

The discipline of genetics has slowly evolved a vocabulary to explain virtually all natural phenomena, including congenital malformations, in terms of the genetic theory of inheritance. Moreover, in experimental work, the geneticist must of necessity eliminate as far as possible all environmental variables. As the chemistry of the chromosomes advances, further support is given to the basic biological principle that everything is, in the last analysis, due to the gene. But actually both genetic and environmental factors are of importance and in the case of congenital malformations the possible influence of environmental factors must not be overlooked.

In Table I are summarized all the known non-genetic factors which have been implicated in the development of congenital malformations either in man or experimental animals. The data on the experimental side is restricted to those factors shown to operate in the placental mammal.

In Group A (the influence of the maternal diet) only one factor, protein deficiency, is based on clinical findings and is, at the moment, a tentative one. All other factors in this group are derived from the observation of naturally occurring malformations in domestic mammals or from

TABLE I.—ENVIRONMENTAL FACTORS IN THE PRODUCTION OF CONGENITAL MALFORMATIONS

A. *The Influence of the Maternal Diet*
1. Starvation. Protein deficiency
2. Copper deficiency. Iodine deficiency
3. Vitamins:
(*a*) deficiency: vitamin A, riboflavin, folic acid, thiamine, vitamin E
(*b*) excess: vitamin A
(*c*) vitamin antagonists: galactoflavin: x-methyl pantothenic acid, sodium omega methyl pantothenate, pantoyltaurine: 6-aminonicotinamide: folic acid antagonists

B. *Hormonal Factors*
1. Pituitary: preloban, ACTH, posterior pituitary extract, vasopressin
2. Thyroid: thyroxine, methylthiouracil
3. Pancreatic islets: insulin, alloxan
4. Adrenal cortex: cortisone
5. Ovary: œstradiol benzoate

C. *Physical Agents*
1. X-radiation
2. Decompression: hypoxia; anoxia
3. Hypothermia; hyperthermia

D. *Chemical Agents*
1. Radiomimetic substances; nitrogen mustard
2. Antibiotics: penicillin and streptomycin; Terramycin; actinomycin D
3. Purine antagonists
4. Nucleic acid antagonists
5. Leucine antagonists, DON
6. Chelating agents: ethylenediaminetetracetic acid
7. Azo dyes: trypan blue, Evans blue, Niagara blue 4b, Niagara sky blue 6b
8. Miscellaneous: salicylates, nicotine, urethane, phenylmercuric acid

E. *Pre-natal Infection*
1. Rubella
2. Toxoplasmosis

F. *Mechanical Factors*
1. Faulty implantation of the ovum
2. Disease of the placenta
3. Interruption of umbilical blood flow
4. Ectopic pregnancy
5. Amniotic bands

animal experimentation in the laboratory. It is worth stressing the possible significance of maternal vitamin levels in the normal development of the embryo. Just as vitamins are essential substances which the body does not manufacture, so the hormones are essential substances which the cells of the body in general cannot make for themselves. It is not perhaps surprising, therefore, that hormones play a role in the ætiology of the congenital malformations. But here again, although thyroid deficiency is an obvious and important cause of human malformations, of the other factors in Group B (hormonal factors) only cortisone has ever been implicated in the causation of a human deformity. In Group C (physical agents), X-radiation is not only the most fully analysed of all the experimental teratogenic agents, but has also been held responsible for certain malformations in man. Group D (chemical agents) is derived from experimental studies only, and consists mostly of substances which interfere with mitosis or with the metabolism of substances essential to cellular differentiation, although the mode of action of a number of chemicals in this group, such as the azo dyes and the antibiotics, is not yet understood. On the other hand Group E (pre-natal infection) contains two factors whose teratogenic activity in the human is undoubted but which are not teratogenic agents in the experimental animal. In the last category, Group F (mechanical factors), are a number of factors, none of which is supported by experimental evidence, but any or all of which may be of significance to the development of the human embryo. At the present time their importance must be borne in mind but is, as yet, not proven.

During the twenty years in which the science of experimental mammalian teratology has evolved, it has gradually been established that agents which damage the developing fœtus follow certain general principles. The most important of these is that the vulnerability of any structure to a teratogenic agent depends not so much on the intensity of dosage but on the period of pregnancy during which it is administered. For example, in the rat the critical developmental period of the kidney is the eleventh day of pregnancy when irradiation of the dam produces the highest incidence of deformities, such as horseshoe kidney. On the other hand, the critical period for the heart is two days earlier, and cardiac malformations are produced most readily by irradiation of the dam on the ninth day of pregnancy. For each teratogenic agent there is therefore a characteristic period of influence on a specific structure of the body, a period when that particular structure is especially vulnerable to that particular agent. This period of vulnerability seems to coincide with that of greatest mitotic activity in an organ and therefore with the period of most active differentiation and growth. Outside this period the survival of any particular group of cells is no more at risk than the life of the embryo. It is thus probable that the factors responsible for the occurrence of human malformations do not differ from structure to structure and that what causes the persistence of a patent ductus arteriosus, for example, is strictly comparable to what determines the presence of a cleft palate.

A second important principle is that there is only a small area in the spectrum of activity of any teratogenic agent in which it is capable of producing deformed young. If the agent is administered in too small a quantity, the young are born normal; if in too large a quantity, the embryos are killed almost immediately and either aborted or resorbed. The situation is comparable to that which has brought rubella, alone among the virus diseases, into prominence as a teratogenic agent.

Vitamin A occupies a special place amongst the known teratogenic agents, because both excess and deficiency of the vitamin are equally deleterious

to the development of the embryo. In the experimental animal *hypovitaminosis-A* can be used to produce the following deformities: anophthalmia, microphthalmia, coloboma, anomalies of the iris; hydrocephalus; incomplete ventricular septum of the heart and transposition of the great vessels; tracheo-œsophageal fistula; horseshoe and unascended kidneys; ectopic ovaries and cryptorchidism; diaphragmatic hernia; harelip; cleft palate; accessory ears; malformed hind-limbs.

Hypervitaminosis-A can produce anophthalmia, microphthalmia, exophthalmos, coloboma, exencephaly, hydrocephalus, spina bifida, harelip, cleft palate and shortening of the lower jaw and maxilla. There is therefore a remarkable similarity between the ranges of deformities produced by both hypo- and hyper-vitaminosis-A.

Current concepts of human biology both demand and imply that the gene occupies first place. If, however, we are to strive for prevention of malformations we can at present anticipate little prospect of success from a direct attack upon the gene. Although generally accepted it is not as yet proven that abnormalities of the genetic apparatus result in the occurrence of malformations. The recent discovery of the presence of an extra chromosome in mongolism does not necessarily prove that it actually causes the mongolism, for the extra chromosome may merely be an additional manifestation of the basic cause of the more obvious deformities. It seems probable that future advances in the understanding of the ætiology of congenital malformations will come from the study of the manner in which the genetic inheritance of the individual is modified by the environment.

Dr. D. Y. Mackenzie (London):

The Management of Congenital Abnormalities

In sharp contrast to the dramatic decrease in the incidence of diseases of childhood, which a few decades ago had a high morbidity and mortality, there remains a large group of developmental disorders initiated *in utero*. Congenital abnormalities which can be detected clinically occur in about 1% of live births, while investigation has revealed abnormalities in up to 7% of live births (Hendricks, 1955) although all of these do not necessarily interfere with health and activity. Mortality figures for the pre-school child are reduced in all categories except congenital malformations and neoplastic disease. An increasing percentage of the work in children's hospitals is concerned with treatment of congenital abnormalities.

Accurate statistics of the number of handicapped children are not available, but it is estimated that if the handicapped child is defined as one with a physical or mental state which interferes with normal growth and development, then 10% of all children come within this category, the majority of disabilities being congenitally determined.

The approximate distribution of congenital malformations is given in Table I, which shows the high incidence in the locomotor system.

TABLE I.—DISTRIBUTION OF CONGENITAL MALFORMATIONS

Locomotor system	40%
Central nervous system	14·7%
Genito-urinary system	10%
Cleft palate and harelip	8%
Skin	5·5%
Gastrointestinal system	5%
Ear, nose and throat	4%
Cardiac	4%
Others	8·8%

In many of these the defect is localized and amenable to corrective orthopædic surgery. Abnormalities of the central nervous system are second in frequency but are more difficult to treat and constitute the majority of severe congenital abnormalities.

Advances in medicine and an awakening social conscience have resulted in a reappraisal of the problem of the disabled child. This paper is primarily concerned with the management of the child severely disabled by congenital abnormalities resulting in serious locomotor disturbances. This includes brain and spinal maldevelopment and certain cases of widespread or multiple involvement of the locomotor system.

The emphasis of treatment has shifted from the malformation itself to a concern for the well-being of the child as a whole. Ideally the disability should be removed altogether, but unfortunately this is seldom possible. The aim of treatment is to enable the child to progress in his total development in as normal a manner as possible. Rehabilitation must be physical, mental, emotional, social, educational and at a later stage vocational.

The parents' role is of great importance and in the past has been too often ignored. It is essential that they understand the problem with which the child is faced. It should be carefully explained to them, honesty being essential where confidence is to be obtained. An optimistic approach must always be maintained and wnere bad prognostic features arise, information can be tactfully conveyed over a period of time. If confidence is not complete the parents will become prey to the often misguided advice of relatives, friends and neighbours.

The problem inherent in the child is essentially one affecting the entire family and the disabled child can be a powerful force for either unity or disunity. Emotional breakdown is a definite

risk in these families and must be prevented if at all possible. All parents experience feelings of guilt, anxiety and frustration. When told that their child is severely disabled and likely to remain so, an emotional vacuum frequently results requiring advice and careful counselling.

The organization of the medical team is generally in the hands of a pædiatrician, ideally one having special knowledge of disabilities in childhood. Because a great deal of therapy is carried out in Departments of Physical Medicine the physician in charge may also find himself supervising the progress of these children. However, it is the integrated team drawn from all departments that is of primary importance. A thorough evaluation is the start of treatment. Attempts should be made to give a prognosis, bearing in mind that the natural history of many of these conditions is one of fluctuation. If possible both parents should attend the consultations, particularly the first and those during which major policy decisions are made. Unnecessary hospital visits can be prevented by the team approach, with consultations, if not together, at least on the same day. Regular progress reviews must be made with a full reappraisal at yearly intervals. Accurate records of progress should be kept and reports circulated to the team members concerned with the management of the child. Ideally these children should always see the same doctor on each visit or at least one of the permanent team. Too often these cases are relegated to a registrar who changes with each visit. The general practitioner must receive regular reports to help him in the general health supervision and care of the child during intercurrent illness.

The work of the physiotherapist is of particular importance in obtaining mobility. A therapist in whom the child and parents will confide is often a valuable source of information on general problems within the family. The attachment of the child to a certain therapist must be accepted as she will invariably obtain better co-operation and results. The aim is to teach the parents to manage the treatment at home, only attending hospital for supervision. Therapy must, where possible, be disguised as play. The occupational therapist can help to achieve co-ordinated use of the limbs and the speech therapist communication skills. The psychologist assesses not only the child's intelligence but also his sensory perceptual losses and the optimum method of education. The school teacher must have full knowledge and understanding of the child's disability. Education is of fundamental importance, and in many instances should take preference in treatment.

Malformations of the central nervous system are common, accounting for probably 50% of those conditions recognized at birth. The majority of cases of locomotor disability are due to cerebral palsy, but cases do occur as a result of damage to the infant brain during the paranatal and postnatal periods as well as from damage during intra-uterine life. Nevertheless a definite proportion of cases are due to a congenital abnormality of the brain and are commonly associated with a corticospinal deficit, such as porencephaly, hydrocephalus, polymicrogyria, Sturge-Weber syndrome and agenesis. If microscopic reduction of nerve cells and fibres is included, the numbers are considerably greater. It is impossible to cover such an important subject here and I shall deal merely with some principles of treatment. I would, however, like to stress the importance of early and full assessment of the case. The brain-injured child constitutes one of the most difficult diagnostic problems. Potential intelligence must be assessed early but the type of intellectual deficit in these children does not lend itself to expression in terms of I.Q. Psychological appraisal involves not only the I.Q. but observations on the child's use of his assets, his willingness and ability to co-operate, the kind of help received from the family, accounts of what he is to do at home and what he can do, as well as the observations of medical, educational and therapy attendants. It must be remembered that neither the I.Q. nor the physical disability is necessarily a reliable guide to prognosis. Associated disabilities such as difficulty in appreciating spatial relationships and in learning to read, may render a formal I.Q. of little prognostic value as to educability.

Of the cases of corticospinal deficit at present attending our department by far the greatest number are suffering from diplegia and hemiplegia.

Early treatment is important for both the parents and the baby. Guilt, resentment and shame produce irrational reactions and may result in unnecessary suffering for the parents and healthy siblings. Parents may reject the affected infant or be over-affectionate and prevent its chance of developing its own personality. It is important at this stage that the mother is given something to do for the baby. Passive movements will maintain joint mobility and the more she can play with the baby the greater the sensory experience on which skilled movement is based. An abundance of co-ordinated afferent stimuli are probably more important at this stage than is generally recognized. The normal child learns skilled acts by repetition, gradually laying down the pattern of sensations which are produced by its correct performance. A store of movement and posture memories is acquired and translated

into activities by repeated practice. In other words, what goes in by the afferents largely determines what comes out by the efferents. Destroyed brain tissue is not replaced but the degree of "take-over" is probably greater at this important formative stage than at later stages. Far too many of these infants are still treated by the "let's wait and see" approach.

The main factors responsible for interference with locomotion are spasticity due to muscular hypertonus, which impairs the range and speed of voluntary movements, paralysis due to impairment of voluntary movement which prevents certain patterns of movements being made with normal force and dexterity, and contractures which limit joint range.

Spasticity remains a difficult condition to treat. Drugs are to date of little help. Whether tigloidine will prove of value as it has done in the control of flexor spasms remains to be seen. Neurosurgery may be helpful in reducing spasticity in the hemiplegic but in general it has little application as yet. The reduction of spasticity by eliciting inhibitory reflex activities such as those described by Magnus (1924), and the reflex reversal of Sherrington (1948) and the use of such reflexes, is of value but there remains a gap between therapeutic enthusiasm and scientific proof.

Contractures can be prevented by physiotherapy provided treatment is begun early enough and the child is reasonably intelligent. Appliances such as a cerebral-palsy chair and night splints are also valuable.

There has been little change in the application of orthopædic surgery to the spastic diplegia problem. The results in general show the disadvantages of a peripheral approach to a central neurological problem. Stoffel's operation of denervation of the calf is impressive in initially abolishing spastic equinus deformity but it invariably recurs. Obturator neurectomy for scissor deformity is disappointing and tendo achillis division usually results in under-correction in which case little advantage is gained, but this is preferable to over-correction and an uncontrollable calcaneous foot. The treatment of choice for equinus deformity remains the Denis Browne technique of serial plasters. Calipers may aid walking performance but should be abandoned if after a fair trial no benefit is obtained. They can also be used to combat contractures but are never a substitute for physiotherapy. Stabilizing procedures in the teen ages may be valuable.

Treatment of the paralytic aspect of the neurological deficit is difficult. Unlike the acquired paraplegic the child has no store of posture and movement patterns on which rehabilitation may be based. Learning to walk is more difficult and may be further complicated by mental retardation, emotional difficulties and lack of drive. The physiotherapist has an important task in teaching and supervising the performance of activities. The range of isolated voluntary movements must be extended, under the guise of play, to everyday activities such as feeding, dressing, washing, standing and walking. Function is more important than style, and the child is happier and more stable if concession is made to the cerebral deficit. Forcing these children to perform in a conventional manner may result in frustration and disappointment. It is worrying to find that most teen-age children severely disabled from cerebral palsy are unhappy and often immature and unduly reserved. If deformity of the personality and serious maladjustment are to be avoided, management during the early formative years requires careful appraisal.

Congenital malformations involving the spinal cord present many difficulties. Severe malformations such as amyelia and myeloschisis are incompatible with extra-uterine life but myelodysplasia with spina bifida may occur in a child otherwise developing normally. Spinal abnormalities may be primarily of the vertebræ or of the neural tube. In the first group the type of abnormality tends to vary with the level of involvement. Thus the cervical spine may show errors of segmentation and fusion, the dorsal spine hemivertebræ formation, the lumbar spine spina bifida and the sacrum hypoplasia or aplasia. Our concern is mainly with spina bifida in its more severe forms. If sufficiently large the protrusion through the defective dorsal rami may involve cauda equina or the cord itself resulting in a myelomeningocele. This differs from a meningocele in being covered not by skin but by a thin translucent membrane which may be granular and leaking in areas. The most severe manifestation of this process is the syringomyelocele or myelocystocele where the central canal is dilated and the thinned out posterior part of the cord accompanies the meningeal hernia. Where there is primary failure of closure of the neural tube there is no sac and the skeletal disturbances are more severe.

The result of involvement of the spinal cord in these malformations is a neurological deficit producing abnormalities in the legs and failure of sphincter control. A variable paralysis occurs in one or both legs. Development of the legs may be defective, the legs being small with hypoplastic muscles and clubbing of the feet. Sensory loss results in trophic sores and the defective sphincter control leads to incontinence and urinary infections. Limb paralysis is greatest with dorsi-

lumbar involvements and least in sacral and cervical involvement, while sphincter involvement is not seen in cranial or cervical lesions but becomes commoner with descent down the spinal axis.

Laurence (1959) reviewed 407 cases of spina bifida cystica and showed that prognosis was related in part to the anatomical site. Cases of meningomyelocele involving the dorsal and sacral regions did fairly well while dorsilumbar and lumbosacral involvement carried the greater risk. Other abnormalities are frequently associated with spinal malformations, particularly hydrocephalus which occurred in 231 cases of whom 179 died. 36% of the cases reported by Laurence survived the early hazards of infection, hydrocephalus and renal failure and were alive after eight years. With advances in antibiotic therapy and surgical technique the number is likely to increase. Like the cerebral group these children have no previous experience on which walking rehabilitation may be based.

Recent progress in urological surgery has considerably aided the management of the sphincter disturbance, often the most troublesome aspect of these cases, and surgical closure of the spinal defect is usually possible although the child may need to wear a protective shield over the affected area. The ease with which mobility is obtained varies with the degree of disability in the legs. Active and resistive exercises aid muscle development and leg activities counteract disuse osteoporosis. The sensory loss leads to faulty position of the legs and considerable strain on joint structures. It is important to ensure that the joints are in a good position during immobility as well as on walking. Support in the form of polythene splints or calipers may be required particularly in the early stages of standing and walking training. Confidence in the early stages is best achieved by the physiotherapist supporting the child. Later use of a walker, or clumpers and of sticks may aid in the attainment of mobility. A variety of orthopædic operations are performed to achieve stability and weight-bearing alignment. Shoes are invariably a problem in these children. Often they appear to be inadequately designed with poor rigid support leading to unequal pressure and possibly ulceration. This in turn leads to immobility with all its attendant disadvantages. My clinical impression is that improvement in the circulation in the legs, where defective, has sometimes followed the administration of bamethan.

Other malformations are less common although we have at present cases of Klippel-Feil syndrome and diastematomyelia attending our department. The Klippel-Feil syndrome is characterized by shortening of the neck due to abnormalities of the cervical vertebræ which are reduced in number, fused or bifid. There is not normally an associated neurological upset, but a gradation occurs to iniencephalus where the brain and cord lie in a sac partly outside the bony framework. This is not compatible with survival but intermediate stages may be seen.

In diastematomyelia the spinal cord divides into two halves each of which undergoes modification of structure. The malformation is rare, usually limited to less than ten segments and the halves are often separated by a bony projection or fibrous band arising from the dorsal surface of the body of the vertebræ. Orthopædic disabilities are usually slight but most cases show some neurological deficit in the legs. In diastematomyelia walking training has been given because of a defective gait while cases of Klippel-Feil syndrome require treatment to minimize the postural deformity of the neck and shoulders.

Malformations of the muscles, joints and bones are common. In most cases the lesions are of a localized nature and amenable to fairly straightforward treatment. Osteogenesis imperfecta, arthrogryposis, certain of the chondrodystrophies, and multiple or severe abnormalities of limb growth, may, however, place the child in the category discussed, in which case the principles of management are similar.

The management of these malformations is assuming increasing importance. Medical specialties are organized to treat rather than to prevent disease and to a great extent are divided by anatomical boundaries and classified to organ systems. Pre-natal disorders are peculiar in not respecting such limits. I have stressed the importance of team-work in management. The long-term approach to this problem must be preventive and a similar team approach is required for research into the complex factors of ætiology.

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May 6, 1960

Anæsthetic Procedures in the Larger Domesticated Animals

By W. D. Tavernor, B.V.Sc., M.R.C.V.S.[1]

Introduction

The problems confronting the veterinary anæsthetist when dealing with large animals such as horses and cattle are twofold: control of movement and relief of pain. Management of the unruly or unco-operative animal may be quite difficult. Restraint is more often necessary for the horse than for the more placid ox. Time-honoured methods of manhandling an animal are tending to become outmoded and replaced to a greater extent by tranquillizers and sedatives.

Equine Anæsthesia

For major surgery on the horse, recumbency and restraint are essential. They can be accomplished in several ways. The animal may be put into a state of recumbency by means of ropes and hobbles prior to the induction of anæsthesia. This method is not free from risk both to operator and animal and is most inadvisable with racehorses in training.

An alternative method of inducing recumbency in horses which is increasing in popularity is the intravenous administration of the muscle relaxant succinylcholine chloride (Hansson and Edlund, 1954; Hansson, 1956, 1957; Belling and Booth, 1955; Stowe, 1955; Larsen, 1958; Neal and Wright, 1959). Within 30 seconds of receipt of a 0·2 mg/kg dose muscular fasciculations are seen, especially over the shoulder regions, due to the depolarization of muscle groups. The limbs flex and the animal falls quietly to the ground within 45 to 60 seconds when its limbs can be secured to prevent rising. The levels of cholinesterase in equine plasma are high, consequently the effect of the relaxant wears off completely within six to seven minutes. General anæsthesia may then be induced if required.

Other methods of casting are by the induction of anæsthesia in the standing animal. This may involve the use of chloroform, chloral hydrate or the barbiturates. Where quiet animals are concerned this is relatively easy, but with unco-operative patients prior sedation of the animal greatly facilitates the procedure.

Sedation is playing an increasingly important part in equine anæsthesia. In the most recalcitrant animals this may be achieved by creating a thirst and administering chloral hydrate in the drinking water.

When the animal can be handled, sedation may be accomplished by the use of phenothiazine derivatives intramuscularly or intravenously. Promazine hydrochloride (Cunningham, 1959) and trimeprazine tartrate (Tavernor, 1960) are safe and effective when given intravenously. Chlorpromazine hydrochloride when given intravenously shows idiosyncrasies in the form of the animal sinking down on its hocks and then suddenly springing forwards. The writer has not observed this effect following intramuscular administration although Owen and Neal (1957) report floundering in some cases. The time of onset is longer than when given intravenously and the depth and duration of sedation is variable. These drugs produce a state of sedation from which the animal may be roused by noise or continued handling. Pentobarbitone sodium may also be used as a sedative when given intravenously at the rate of 65 mg/50 kg (Arthur *et al.*, 1953). The animal is quietened but does not lose the ability to stand.

When it is decided to induce anæsthesia in the standing animal the problem of administering large doses and volumes of drugs arises. In the case of chloral hydrate this may take up to four minutes during which time quietness of the patient is most important. Sedation goes a considerable way towards solving this problem.

The anæsthetic procedures adopted in the horse may be considered under three main headings: regional anæsthesia; narcosis; general anæsthesia.

Regional anæsthesia.—This may consist of local infiltration, specific nerve blocks, or spinal anæsthesia. Nerve blocks are mainly confined to the limbs and head. Plantar nerve block may serve more than one purpose: diagnosis of the seat of lameness; performance of nerve section, and general surgical interferences in the lower part of the limb and foot.

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Spinal anæsthesia as practised in the horse is extradural and is confined to posterior (or low) anæsthesia. The spinal cord and meninges end in the midsacral region and the site of injection is at the first intercoccygeal space. The spinal canal is here occupied by the coccygeal nerves and some small veins. This type of anæsthesia is of value in operations on the tail and perineal region, but if interference with hind limb function is to be avoided the total quantity of anæsthetic solution injected in an average-sized hunter must not exceed 15 ml of a 2% solution of procaine. Doses in excess of this are likely to involve the lumbosacral plexus with consequent inco-ordination of the limbs and inability to stand.

Narcosis.—A state of narcosis is valuable for operations under local and regional anæsthesia. The animal's fear of restraint is overcome and the risk of sudden or vigorous movement is reduced. Narcosis is also a useful preliminary to the induction of general anæsthesia when inhalation anæsthetics such as chloroform are employed.

For induction of narcosis in the horse, the agent of choice is chloral hydrate (Wright, 1944, 1957, 1958). This may be given intravenously or orally and is used to produce depths of narcosis varying from a light stupor to complete general anæsthesia. Intravenously chloral hydrate is administered as a 10% solution and may be given to the standing or recumbent animal. In the former case the patient will fall to the ground when a state of medium to deep narcosis is reached. The amount of chloral hydrate required to attain this narcosis in the average-sized hunter is 5–6 g/50 kg, giving a total volume of ½–¾ litre. The optimum time taken for induction is four to five minutes, and since chloral hydrate is irritant, care should be taken to avoid perivascular leakage.

In medium narcosis nystagmus commences and persists until deep narcosis supervenes, the tail becomes limp and respiration slow, regular and deep. The corneal reflex is active and the pupils are slightly constricted. In anæsthesia the eyelids close. As anæsthesia deepens respiration becomes slow and shallow, the anal reflex is lost, and in the male the penis prolapses from the prepuce. The pupil constricts but the corneal reflex persists up to the point of bulbar paralysis.

Recovery from chloral hydrate narcosis is usually smooth, and the time taken from injection to the patient regaining its feet is usually from forty-five to sixty minutes. It is normal practice to keep the animal secured by hobbles until it is judged that on attempting to rise it will be able to stand.

General anæsthesia.—As already stated a large proportion of equine surgery may be readily performed using a balanced anæsthesia consisting of chloral hydrate narcosis supplemented by local infiltration or regional nerve block.

When it is necessary to induce full surgical anæsthesia, a variety of techniques are available to the veterinary surgeon. For short periods of anæsthesia intravenous chloral hydrate may be employed as the sole agent, continuing from the state of narcosis previously described. If repeated doses are given the recovery time is greatly extended. It is preferable to induce light anæsthesia only with chloral hydrate and maintain with barbiturates or volatile agents.

Barbiturates are effective anæsthetic agents in the horse, but may produce narcotic excitement and also struggling on recovery (Wright, 1958). This must be controlled by restraining the patient until full consciousness is regained.

For this reason the use of barbiturates is mainly restricted to induction prior to maintenance with a volatile agent, or occasionally for maintenance when chloral hydrate has been the initial anæsthetic agent. In this latter respect, pentobarbitone sodium is very effective; the initial dose for the average hunter weighing 450 kg, which has already received chloral hydrate at the rate of 6–7 g/50 kg, is between 1·0 to 1·5 g. Further doses may be given at intervals as required. Following such anæsthesia the recovery time is slightly prolonged but it is usually quiet.

When used for induction the barbiturates may be given to either the standing or recumbent animal. A dose of 1 g/100 kg of thiopentone sodium can be given as a rapid intravenous injection to the standing patient, which will fall to the ground relatively quietly 30–60 seconds later. When given to the recumbent patient the dose is approximately the same but it is given by slow intravenous injection, the plane of anæsthesia being assessed by observation of reflexes.

Following induction by thiopentone sodium or chloral hydrate, anæsthesia may be maintained by chloroform, cyclopropane or halothane.

Chloroform is truly a time-honoured anæsthetic agent in the horse, its use being recorded as early as 1847 (Percival, 1848). As a sole anæsthetic agent it has been largely superseded by chloral hydrate but in certain short operative procedures it is still widely used. It may be given to the standing or recumbent animal but in the former case the narcotic excitement that may ensue during induction in a spirited horse may prove to be highly dangerous. It is usual to cast the animal first and then to administer from 1 to 2 oz on cotton-wool or sponge in a close-fitting mask.

The disadvantages of chloroform are the incidence of post-anæsthetic pneumonia and liver damage. The advantage on the other hand is the rapidity with which it is excreted once administration ceases, and the speed with which consciousness is regained. The fact that the animal is able to rise and walk within half an hour of completion is a matter of great moment in veterinary practice.

When cyclopropane or halothane is used as an anæsthetic agent it is usual to premedicate with one of the phenothiazine derivatives and atropine sulphate, and induce with thiopentone sodium. Maintenance is with closed circuit via a cuffed endotracheal tube. Animal size is again a problem. Rebreathing bags of 25–35 l. capacity are necessary and carbon dioxide absorbers must contain up to 3·5 kg of soda lime. A minimum airway of 3·8 cm diameter must be maintained between the endotracheal tube and the soda lime canister. Endotracheal tubes are correspondingly large, their dimensions ranging from 1 to 2 cm internal diameter and from 60 to 90 cm in length. Large quantities of gases are, of course, required, but may be delivered to the circuit via pressure tubing.

This type of anæsthesia is indicated in protracted interferences or for experimental surgery. Satisfactory anæsthesia may be maintained for several hours followed by a relatively speedy and quiet recovery (Dyce *et al.*, 1952; Fisher and Jennings, 1958).

Bovine Anæsthesia

The majority of the bovine species are relatively docile. Handling and restraint do not present the problems associated with the horse. The bovine temperament is more placid than that of the equine, and the animal is more inclined to stand for quite long periods. Anæsthetic techniques are, however, governed by the multiple ruminant stomach. The stomach of the ox is very large and occupies nearly three-fourths of the abdominal cavity. It consists of four parts, viz. rumen, reticulum, omasum and abomasum. The capacity of the stomach varies greatly but in the medium-sized cow is 30 to 40 gallons of which 80% is accounted for by the rumen. The rumen is in effect a vast fermentation chamber in which the first stages of cellulose digestion take place. Quite large quantities of gas are produced in this process and these gases are voided by eructation. Food material is masticated on more than one occasion and is easily regurgitated from the stomach to the mouth. Once the swallow reflex has been depressed on induction of anæsthesia, ruminal regurgitation followed by inhalation pneumonia is a distinct hazard. To this may be added the danger of ruminal tympany due to inability to eructate, and consequent pressure on the diaphragm. With these facts in mind it is easy to see why regional anæsthesia in the standing animal plays such an important part in general bovine surgery.

If the animal is in any way obstreperous it may first of all be sedated with chloral hydrate or one of the phenothiazine derivatives. It is advantageous that the patient should not lie down if the operative procedure is to be performed under regional anæsthesia in the standing animal.

Regional anæsthesia.—Many procedures may be performed under local infiltration, but specific nerve blocks play a very important part in cattle. That most commonly used is paravertebral block of the thirteenth thoracic, first, second and third lumbar nerves (Farquharson, 1940) for abdominal interferences and operations about the flank in the standing patient. The technique is very similar to that used in the human subject. The dorsal and ventral branches of each nerve are anæsthetized after emergence from the intervertebral foraminæ.

Extradural anæsthesia plays an important part in bovine surgery, especially in obstetrical interventions and operations on the tail and perineum. The sites of injection are the sacrococcygeal and first intercoccygeal spaces. The spinal cord ends in the region of the last lumbar vertebra, and the meningeal sac extends as far as the third and fourth sacral segments. At the site of injection the canal contains only coccygeal nerves and small blood vessels.

Posterior anæsthesia may be obtained with quite small quantities of anæsthetic solution (10 ml in a medium-sized cow). The vertebral canal widens rapidly as it extends forward. The diameter in the sacral region is approximately 1·8 cm posteriorly and 2 cm anteriorly. In the last lumbar segment the width is 4 cm. Thus paralysis of the sacral nerves supplying the lumbosacral plexus may be achieved with comparatively small quantities of anæsthetic solution (20 ml) whereas paralysis of the anterior lumbar nerves requires much larger quantities (100 ml or more). The bovine is quieter than the horse and is therefore a more suitable subject for anterior epidural anæsthesia, which may be used for operations on the hind limb and mammary gland.

Narcosis.—Narcosis plays a far less important part in bovine surgery than in the equine. The agent of choice is again chloral hydrate administered intravenously as a 10% solution. The lightly narcotized bovine retains its swallow reflex, and if kept in ventral recumbency the dangers of ruminal regurgitation or tympany are

not great. Operative procedures may then be carried out using local anæsthesia.

General anæsthesia.—General anæsthesia in cattle is only occasionally necessary. It is, however, indicated in certain protracted interventions and in experimental surgery. It is advisable, when general anæsthesia is induced, to intubate the patient with a cuffed endotracheal tube irrespective of the anæsthetic agent.

Chloral hydrate may be employed alone as a general anæsthetic or it can be supplemented with pentobarbitone sodium. Induction and recovery are good but the danger of regurgitation is always present. Ruminal tympany is a particular hazard during lengthy procedures.

The barbiturates as anæsthetic agents are not widely used. In the calf, although giving excellent anæsthesia, the recovery time is extremely protracted and may be as long as twenty-four to thirty-six hours. Their use is mainly restricted to supplementation of chloral hydrate anæsthesia, and for inducing general anæsthesia prior to use of volatile agents.

The dangers of chloroform previously outlined under equine anæsthesia also apply to cattle. Delayed chloroform poisoning is more common and salivation that occurs with all volatile anæsthetic is excessive. This profuse salivation is only partially controlled by the administration of atropine sulphate.

If prolonged anæsthesia is required, a volatile agent in a closed circuit is indicated. By use of a cuffed endotracheal tube the danger of inhalation pneumonia is avoided (Messervy and Jones, 1956). For the adult bovine the size of equipment is similar to that described for the horse.

The normal sequence of events could be premedication with trimeprazine tartrate and atropine sulphate; induction with thiopentone sodium; intubation and maintenance with the volatile agent of choice. Cyclopropane and halothane (Fisher and Jennings, 1958) are extremely effective and safe agents. With this technique the animal may be kept anæsthetized for several hours and recovery is invariably smooth.

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DISCUSSION

In reply to questions, **Mr. Tavernor** said that endotracheal intubation was comparatively easy in the horse or cow; only in the cat was laryngeal spasm a problem.

The pneumonia following prolonged recumbency in large animals was associated with a pulmonary œdema. This might be hypostatic in origin or of unknown ætiology; it was quite distinct from the inhalational pneumonia which he had mentioned in cattle.

With regard to reports of sudden death following the use of darts tipped with succinylcholine, he did not think that this was due to respiratory failure. With normal dosage the duration of apnœa in the horse did not exceed 30–60 seconds and artificial ventilation was very rarely necessary. A bradycardia was not seen under these circumstances and atropine afforded no protection; indeed an extreme tachycardia was very commonly observed. He thought it most likely that these deaths which had been reported chiefly in the zebra were due to primary cardiac arrest, probably associated with cardiac disease.

Section of Psychiatry

President—R. Ström-Olsen, M.D.

Meeting
February 9, 1960

SYMPOSIUM ON ORBITAL UNDERCUTTING

Late Results of Orbital Undercutting

Report of 76 Patients Undergoing Quantitative Selective Lobotomies

By William Belcher Scoville, M.D.
Hartford, Connecticut, U.S.A.

Since 1948, when the author first proposed cortical undercutting [1] as a method of interrupting cortical connexions from various surface areas of the frontal and temporal lobes, the selective leucotomy operation of "orbital undercutting" of the frontal lobes has been performed on 94 private patients and 41 state institutional patients in Connecticut. They constitute two distinct categories of patients both in the malignancy of their mental illness and in their cultural backgrounds. Previous reports have been made on the early results in various diagnostic categories, ranging from benign psychoneuroses to malignant schizophrenic psychoses [2, 3, 4, 5]. Observations have been published on certain physiologic changes resulting from stimulation and destruction of anatomic areas within the frontal and temporal lobes [6, 7]. Presentation is now made of the late results of orbital undercutting, an operation which has largely replaced other selective operations.

Historical

Trends and cycles in psychiatric treatment change inexplicably. In the latter half of this century, the static, organic Kræpelinian school has successively given way to psychoanalysis; to shock therapy; to lobotomy; and, more recently, to newer drugs and chemotherapies. Probably the greatest benefit of the surgical, electrical and chemical therapies has been a luring of psychiatrists away from purely Freudian concepts back to organic medicine. Although at present in both America and Britain psychosurgery is temporarily eclipsed by new trends in drug and shock treatment, it does continue to have a definite place in the relief of mental disease.

Drug therapy has definite limitations in the more intractable emotional and psychotic disturbances. Shock treatment is largely limited to depressive diseases; it fails to prevent recurrences in these depressions; it may increase anxiety, tension and somatic symptoms in the chronic neuroses; and it is unsafe in the elderly. There are permanent sequelæ of insidious mental blunting and measurable memory loss resulting from repeated courses of shock treatment similar to those occurring after recurrent brain injuries in prize fighters. All too frequently these late effects are blamed on the natural course of the patient's disease.

Complete lobotomy has been largely replaced by limited selective operations especially in the benign psychoneuroses and depressions, and in selected schizophrenic patients with a high cultural background [8, 9, 10, 11, 12, 13, 14]. The classical standard lobotomy or leucotomy is now advocated only in deteriorated schizophrenic patients of low cultural level requiring continuous restraint and nursing care. Even in such cases selective undercutting of the superior convexity of the frontal lobes gives comparable benefit with less personality blunting [1]. However, the principal application of selective lobotomies is in the neuroses, depressions and certain senile states. Such selective lobotomies, especially orbital undercutting, should be the treatment of choice in those recurrent depressions requiring more than a limited course of shock treatment, in seriously disabling anxiety-tension states, in intractable obsessive-compulsive syndromes without excessive narcissism and egocentricity, and in certain anxious, agitated elderly people. Unexpectedly gratifying results are obtained in the latter group.

Other Operations (Fig. 1)

The criteria for the type and location of the newer selective operations should be maximum improvement with minimum personality deficit, using a technique which can be exactly duplicated from patient to patient. Bilateral medial quadrantic sectioning or electrocoagulation [8, 14] satisfies the first criterion very well; but precise duplication is difficult because of blind sectioning by electric or chemical agents without measurable control over the spread of destruction of the internal white matter containing concentrated bundles of fibres. The trans-orbital lobotomy of Fiamberti [15] and Freeman [16], in spite of its extreme simplicity, is undesirable in the more benign illnesses because of its complete lack of precision. When done, it should be performed

by surgeons and not psychiatrists. Bilateral fractional ablations of the medial temporal lobe [5] have not shown sufficient benefit to warrant its use in mental illness and may cause memory loss [17]. Certain psychosurgeons have stressed the role of the rostral cingulate area and its effect on obsessive-compulsive thinking. Cairns and later Whitty [18], Lewin [19], LeBeau [9], Livingston [20] and Ward [21] have done modified undercutting or resections of this area. In more extensive interruptions of the rostral cingulate cortex, we have not noted any appreciable specificity [1]. In the more malignant psychoses occurring in well-preserved personalities, undercutting of the superior convexity has been advocated [1], an operation duplicated in later years by McKissock [10] with his rostral leucotomy and by Pool [22] with his bimedial prefrontal lobotomy.

However, to an increasing degree, we have imited psychosurgery to orbital undercutting because of its simplicity; the absence of personality blunting; the preservation of adjacent and deep blood supply, and most particularly because of the ability to duplicate in successive patients, under direct vision, a quantitative sectioning of connexions from measured surface areas. British and Scandinavian surgeons, especially Northfield [23], Tow and Lewin [12], Knight [24], Busch [2] and Sjöqvist [2], have reached similar conclusions about this procedure, which in England is called orbital leucotomy, in Sweden orbital undercutting, and in Denmark orbito-medial leucotomy (Fig. 2).

Case Selection

The present review is limited to the late results in patients who have undergone orbital undercutting and who have not suffered from mental deficiency. Of 92 private patients, 42 have been followed for more than four years (an arbitrary minimum to permit study of approximately 50 patients), a maximum of eleven years and an average of 6·2 years. Of this "late follow-up" series, 12 had malignant schizophrenic types of psychoses and 30 benign. All patients in the latter group aged over 65 years were additionally studied in a separate category. They included schizophrenia (5 cases), pseudoneurotic schizophrenia (7 cases), depressions (11 cases), neuroses (15 cases), and "elderly" (14 cases). The majority of these patients were operated upon on the private neurosurgical service of the Hartford Hospital and discharged to their homes. They represent patients of some private means from appreciably high cultural backgrounds. This group was evaluated separately from 34 cases of schizophrenic patients followed over a ten-year period in two state mental institutions. It was anticipated that the late results would be poor in this latter group, as they were patients of poor economic and cultural background, often seriously deteriorated, and without facilities for care or rehabilitation outside the institution. Follow-up reports have been obtained from members of the immediate family or supervising physician by telephone communication, printed questionnaires, and personal examination of most of the private patients.

The institutional and private categories were roughly comparable in age and sex, the schizophrenic and pseudoneurotic schizophrenic patients being relatively young with an average of 37 years, three-fifths undergoing operation under the age of 40. The psychoneurotic patients were in the middle age group with an average of 54 years, two-thirds being above the age of 40. The depressed patients were older, averaging 63 years, all of them being operated upon over the age of 40, and the "elderly" group averaged 72 years, no case being younger than 65, the majority in their 70's and three cases in their 80's. Complications and physiologic observations were recorded on a total of 128 cases undergoing orbital undercutting.

Results

Psychiatric (*see* Tables I and II).—The results are tabulated under the headings (1) "marked benefit", constituting a clinical cure or marked improvement, permitting the patient to live at home and return to his former occupation; and (2) "significant benefit", constituting moderate improvement, marked improvement or clinical cure; as described by relatives and supervising doctors [1]. Two other headings in Table I indicate a progression or regression in improvement over the years of study. "Early" follow-up studies were made between the third and twelfth months post-operatively.

The "late" results (Table I) in the private patients revealed a significant improvement in all diagnostic categories with certain unexpected variations. The best late results occurred, to our surprise, in the schizophrenic group. All 5, or 100%, showed a marked benefit as compared to 20% with early benefit. This was confirmed to a less dramatic degree in the state hospital cases. The depressions and "elderly" states closely approximated this result, 93% and 86% respectively showing marked improvement as compared to 64% and 50% in the early results. The psychoneuroses and pseudoneurotic schizophrenic groups had an appreciably lower percentage of marked improvement, being 63% and 57%, respectively, but again increased considerably over the early results. In fact, the pseudoneurotic schizophrenics showed the same degree

TABLE I.—PRIVATE PATIENTS: RESULTS

Diagnostic category	No. of late follow-ups (average 6·2 years)	Average age (in years)	Marked benefit or clinical cure		"Significant" benefit†		Advance from original improvement	Regression from original improvement
			Early	Late	Early	Late		
Schizophrenia (9 patients)	5	34	1 (20%)	5 (100%)	3 (60%)	5 (100%)	5 (100%)	0 (0%)
Pseudoneurotic schizophrenia (11 patients)	7	34	1 (14%)	4 (57%)	4 (57%)	5 (71%)	4 (57%)	1 (14%)
Psychoneuroses (37 patients)	16	54	6 (38%)	10 (63%)	16 (100%)	12 (75%)	8 (50%)	6 (38%)
Depressions (35 patients)	14	64	9 (64%)	13 (93%)	13 (93%)	13 (93%)	6 (43%)	1 (7%)
Total patients 92	42	47	17 (40%)	32 (76%)	36 (86%)	35 (83%)	23 (55%)	8 (19%)
*Elderly** (29 patients)	14	72	7 (50%)	12 (86%)	13 (93%)	12 (86%)	7 (50%)	2 (14%)

*Omitted from the total inasmuch as they are duplicated under Psychoneuroses and Depressions.
†"Significant" benefit represents all patients showing moderate or marked benefit or clinical cure.

TABLE II.—STATE HOSPITAL CASES: 10-YEAR FOLLOW-UP ON SCHIZOPHRENIC PATIENTS

	Cases	Average age	Marked improvement		"Significant" improvement (moderate and marked)	
			Early	Late	Early	Late
Connecticut State Hospital . .	18	34	6 (33%)	11 (61%)	13 (72%)	15 (83%)
Norwich State Hospital . .	16	43	1 (6%)	6 (38%)	6 (38%)	11 (69%)
Total	34	39	7 (21%)	17 (50%)	19 (56%)	26 (76%)

of dramatic increase in late benefits as did the schizophrenic categories. If moderate or "significant" benefit rather than marked benefit is used in classification, all five categories are in reasonable approximation to each other, ranging from 71% to 100%. Here again the psychoneuroses proved more intractable than schizophrenics.

Although the number of private patients in each category is small, the *continuing* improvement of all the patients during the four to eleven years and the unexpected late benefits in all 46 schizophrenic patients is deemed statistically significant. Regression, anticipated in half the cases and especially in the schizophrenic patients, did not occur, the total late "marked" benefits being nearly double that of the early (76% as opposed to 40%). The schizophrenic patients showed the greatest late improvement, increasing from 20% to 100%. The depressions and all "elderly" states were next, and there was not a single appreciable relapse in the depressive patients over a four- to ten-year follow-up. Obsessive-compulsive psychoneuroses and schizophrenic patients with predominantly neurotic overlays proved the most intractable. A majority of patients in all the diagnostic categories advanced beyond their original improvement. Significant relapses occurred only in the obsessive-compulsive symptomatology.

In the 34 schizophrenic patients of the lower economic and cultural scale committed to two state institutions, a similar unexpected late improvement occurred. In fact, in one of the institutions the late results showed six times as many patients exhibiting marked improvement. Orbital undercutting, when performed on schizophrenic patients within state hospitals, resulted in "significant" late benefit in 76% and "marked" late benefit in 50% of patients. This compares very favourably with the results of other more radical lobotomy operations.

In 42 private patients followed from four to eleven years, and in 14 "elderly" patients from the depressed and psychoneurotic groups, the late results were superior in the categories of schizophrenia, depression and the "elderly", averaging 100%, 93% and 86%, respectively; while the psychoneuroses and pseudoneurotic schizophrenics showed 63% and 57%, respectively; or an overall average of 76% with "marked" benefit and 83% with "significant" benefit. Although showing much less overall benefit, patients in the lower economic and cultural range showed an equal amount of late over early improvement.

It is most important to do only conservative undercutting in the older age groups to prevent personality deterioration [3, 7]. After conservative operation, these elderly patients appeared in better contact with their environment, with a restoration of sleep rhythm, cheerfulness and social responsiveness not previously present; indicating that their pre-operative psychopathology was not due to simple ageing. Psychoneurotic patients suffering from anxiety,

tension and real emotional difficulties do much better, both early and late, than those with rigid personalities exhibiting much narcissism, egocentricity, and masochistic enjoyment of their ritual patterns. In these latter patients, orbital undercutting brings out their underlying egocentricity to a distressing degree.

Physiologic Results and Complications (Fig. 3)

All complications occurred in the early stages, the majority in elderly persons. There were two deaths among the 93 patients, one from cardiac failure on the first post-operative day in a patient of 76 and one on the second post-operative day following a convulsion in a patient of 66. One 83-year-old patient showed a marked one-day improvement followed by a sudden confusional and stuporous state thought to be due to thrombosis. Two elderly patients fell out of bed, one suffering a fractured hip and the other an intracerebral clot requiring secondary evacuation and lobectomy with subsequent deterioration. We now place all elderly post-operative lobotomy patients in a net cage [25] fastened over the bed for the first twenty-four to forty-eight hours, unless special nursing care is available.

When pseudoneurotic schizophrenic patients undergo selective lobotomies, relatives and physicians must be warned in advance of the possibility of bringing to the surface underlying schizophrenic symptoms. Such patients apparently cloak their psychotic delusions in an obsessive-compulsive or somatic conversion overlay. Provided there is advance warning, lobotomy appears justified, inasmuch as it enables the patient to ventilate his underlying delusions and make better contact with society. In only one case was a later commitment necessary, and that only after a ten-year interlude.

There were no infections. There were three blood clots requiring open drainage, one following a fall from bed. In comparison with certain other lobotomy operations urinary incontinence and temporary confusional states have been largely absent.

Convulsions.—In attempting a ten-year follow-up in the state hospital cases, great difficulty was encountered in obtaining an honest tabulation of isolated convulsions, largely because of neglect of anticonvulsant medication in deteriorated patients and the accurate keeping of hospital records. However, in this series 29% of 41 had one or more seizures. In a series of 121 private patients, of whom 52 were followed an average of 6·2 years, seven (5·7%) developed isolated seizures more than one week post-operatively. Only one of these patients had more than one seizure, indicating easy controllability by phenytoin sodium; and only one patient had seizures more than four years post-operatively, the others occurring in the first, second or third post-operative year. An additional 6 patients had seizures during the first post-operative day without later recurrence, attributed to a too radical extension of the undercutting upwards and posteriorly into the septal area, a known epileptogenic area [7].

The physiologic effects of orbital undercutting have been described in previous papers. Of both scientific and therapeutic importance has been the observation that the uncal area as well as the septal area is sharply epileptogenic. Damage to the septal area may adversely affect states of consciousness and/or produce confusional states, as occurred in 5 out of 121 patients [7]. Hence, caution is urged against too radical posterior or *superior* extension of the orbital undercutting, especially in elderly persons. The line of cleavage must lie exactly at the junction of grey and white matter as one approaches the optic chiasm.

Discussion and Conclusions

In comparing late with early results of orbital undercutting, it is apparent that selective lobotomies, especially cortical undercutting, continue as procedures of great merit in the treatment of both benign and malignant mental disease. The newer drugs and electric shock cannot yet replace them in the treatment of the more intractable neuroses, recurrent depressions, senile agitated states and certain schizophrenic patients of high cultural background. They have the advantage of greater intensity than that offered by drug therapy, and of fewer relapses than seen following shock therapy. As demonstrated in earlier studies, the results in depressions have been dramatic; the results in certain intractable obsessive-compulsive neuroses and in anxiety-tension states, especially in the aged, are more than satisfactory; and similarly drug addiction and alcoholism when due to panic, anxiety or social discomfort are markedly benefited. Caution must be given against using this operation for persons having constitutional psychopathic personalities especially those showing criminal or alcoholic tendencies, as well as for those with obsessive compulsive traits overlying extremely narcissistic and egocentric personalities. Epileptic seizures appear to occur in the early post-operative years and can be easily controlled by phenytoin sodium therapy in co-operative persons not already deteriorated.

Unexpected results of a progressive and ultimately superior benefit followed orbital undercutting in schizophrenic patients from high cultural backgrounds. Neither depressive nor elderly patients have shown appreciable relapses

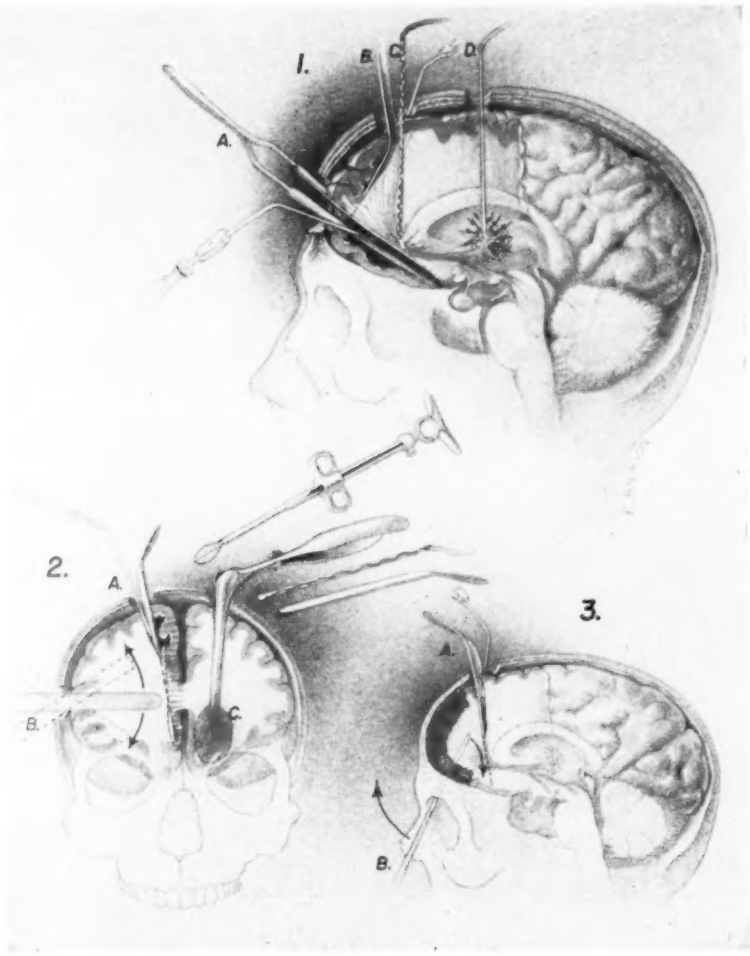

FIG. 1.—Various forms of selective lobotomies: (1) A, Scoville's orbital undercutting. B, Scoville's undercutting of superior convexity. C, Grantham's electrocoagulation of inferior medial quadrant. D, Spiegel and Wycis' stereotaxic electrocoagulation of thalamic nucleus. (2) A, Scoville's cingulate gyrus undercutting. Livingston's cingulate gyrus subcortical sectioning. B, Freeman and Watts' "closed" standard lobotomy. C, Medial inferior quadrant section by McKenzie's leucotome method, Schwartz' nasal speculum method. Grantham's electrocautery method, and Poppen's direct vision suction and spatula method. (3) A, Lyerly and Poppen's "open" standard lobotomy under direct vision. B, Fiamberti and Freeman's transorbital lobotomy. Arrows indicate deep frontal cut. Line hatching indicates Pool's original topectomy of 9 and 10. Dotted hatching indicates his present topectomy of the superior and inferior tips of the frontal lobes.

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in long-term studies. Psychoneurotic patients of the obsessive-compulsive type are more intractable, with more variability and relapses. Pseudoneurotic schizophrenia in younger age groups is not uncommon, and underlying malignant schizoid symptoms are obscured by a superficial overlay of both obsessive and compulsive symptomatology. The neurotic overlay can be removed by orbital undercutting, exposing the deeper psychopathology.

Observation of the psychopathology following section, stimulation or resection of various areas of the frontal and medial temporal lobes indicates that interruption of surface areas only

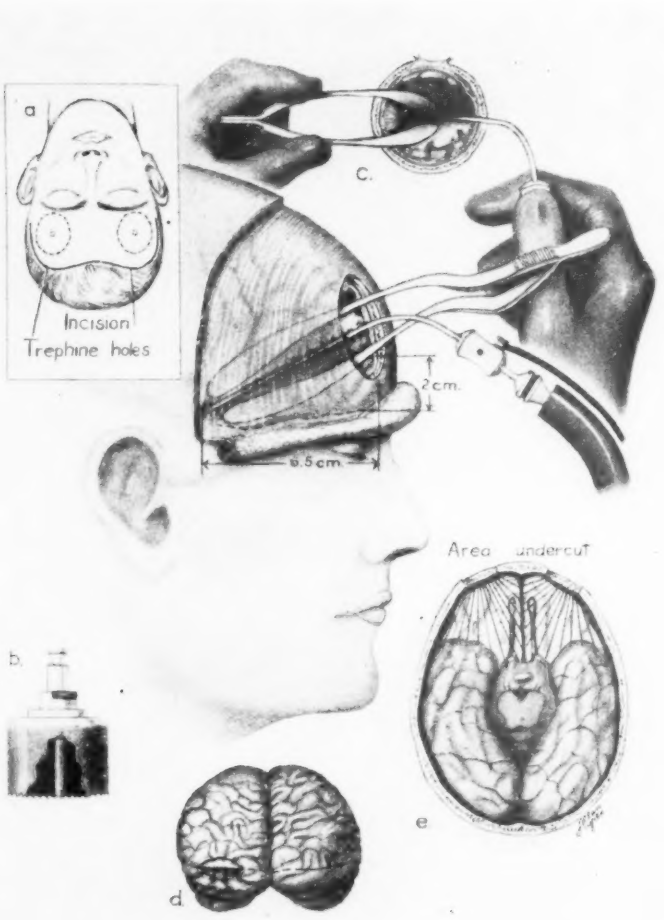

FIG. 2.—Illustration of orbital undercutting showing 1·5 in. trephine hole saw (lower left, *b*); bilateral supra-orbital trephine exposure (upper left, *a*); method of isolation of grey matter by undercutting technique using fine suction tube and spatula forceps (upper right and central figures, *c*); area of orbital cortex undergoing undercutting (lower right, *e*); view from under surface (lower right, *e*); and cortical incision in the tips of the frontal lobes (lower central, *d*).

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indirectly affects the fundamental mechanisms of mental disease and, with the exception of depressions, the benefit of selective leucotomy lies more in a blunting of higher sensitivities than in a changing of disease patterns. In the future stereotaxic, ultrasonic or chemical approaches may be used to reach the deeper mid-line, diencephalic, limbic and reticular systems. To date, lesions made in such areas produce rather than alleviate psychotic delusional and affective aberrations.

Summary

Psychosurgery continues to have definite applications, especially in the involutional and cyclic depressions, the agitated states of the elderly, the better preserved schizophrenics, and the intractable psychoneuroses, particularly in those suffering from anxiety or tension. It is preferred to shock treatment in those depressions requiring more than short courses of shock treatment because of less emotional blunting, memory loss and relapses. Agitated depression

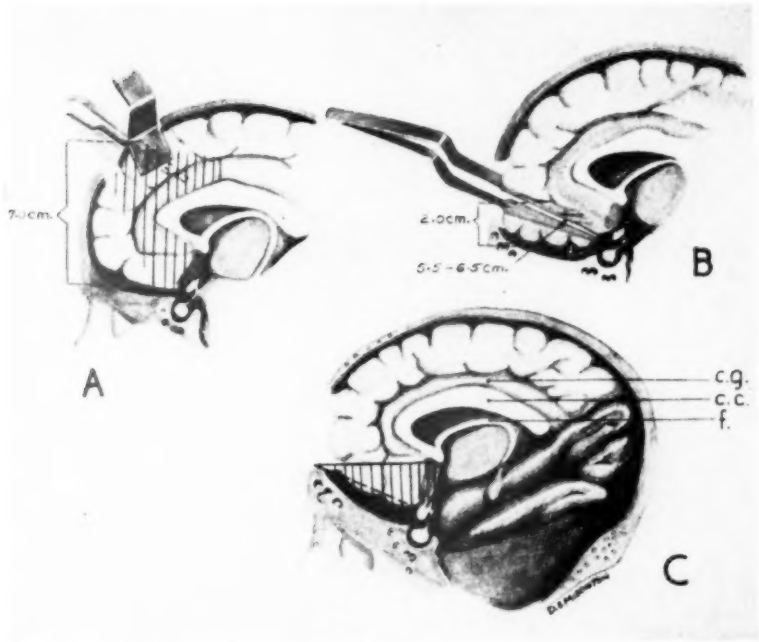

FIG. 3.—A, vertical lines illustrate area of cortex and cingulate gyrus undercut in the operation of rostral cingulate gyrus undercutting. B, standard orbital undercutting operation. C, wrong undercutting extended superiorly into septal area, resulting in loss of consciousness, seizures and later bizarre confusional state. Horizontal lines indicate cingulate gyrus (c.g.), corpus callosum (c.c.) and fornix (f). (Modified from *Rev. neurol.*, 1958, **98**, 762, by kind permission of the publishers, Messrs. Masson et Cie.)

reacts more favourably to limited lobotomy in the older than in the younger age groups.

Complete lobotomy has been replaced by limited selective operations. Undercutting of the orbital cortex offers the advantage of a precise technique under direct vision in an area causing appreciable lift in mood, lessening of anxiety and a minimum of personality blunting. The late results in orbital undercutting when studied in the separate categories of depressions, agitated senile states, schizophrenia, pseudoneurotic schizophrenia and intractable psychoneurosis have in most cases continued to show an improvement rather than regression or relapse. Complications, including seizure formation, occur in the early rather than the late follow-up studies.

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330 Cases of Restricted Orbital Cortex Undercutting

By Geoffrey Knight, F.R.C.S.

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Among psychiatrists there is little need to emphasize the undesirable effects produced by the excessive damage inflicted by the full "standard" leucotomy. The high incidence of epilepsy, the blunting of personality and intellect, the diminution in capacity for enjoyment of work or leisure to which Ström-Olsen and Tow (1949) drew attention, has discouraged the use of surgical treatment in many clinics.

The ideal treatment should modify emotional behaviour whilst minimizing concomitant damage to personality and intellect. The demonstration of the distribution of the thalamocortical projection by Le Gros Clark (1948) stimulated the development of a variety of localized operations on limited cortical areas, and from the various methods available Ström-Olsen in 1950 decided to introduce in this country the technique of orbital undercutting devised by Scoville in 1949. The orbital approach was selected for definite reasons. Early experiments had shown that incisions made far forward under the convexity were not sufficiently effective. The clinical observations of Rylander (1939) indicated that orbital lesions produced changes in emotional tone rather than in intellectual or psychomotor activity; psychometric studies showed that superolateral lesions were more likely to produce intellectual disturbances. Experimental evidence also showed that stimulation of the orbital areas produced autonomic responses whilst their ablation produced tranquillity and loss of fear. Anatomically the line of the incision in the lower and anterior part of the lobe could sever orbital connexions and thereby possibly modify harmful emotions such as fear whilst leaving sufficient pathways open at a higher level for normal emotional appreciation. Fear is a very primitive emotion present in many psychiatric disorders. As the frontal lobes increase in size during evolution the older portions of the lobe remain in the orbital aspect of the human brain, being represented there by the areas of polar cortex from which autonomic responses are obtained. It may be that these represent the site in which our reactions to primitive and harmful emotions are subserved.

We have modified Scoville's incision, restricting the cut to a zone 2 cm wide passing back to a point beneath the anterior limb of the internal capsule at a depth of 5·5 cm from the frontal pole, where the incision is widened to 2·5 cm to catch fibres passing laterally from the capsule (Fig. 1). This modification was introduced to produce evidence of the importance of the ventromedial fibres. The reasons for avoiding damage to the hippocampal relays in the lateral portions of the lobe have been described elsewhere (Knight and Tredgold, 1955). Our earliest successful cases had already had a standard leucotomy performed from the side and hence it appeared that the vertical and lateral portions of a leucotomy incision produced little beneficial effect. All the fibres passing from the thalamus spread from the posteromedial aspect of the lobe and it is this area that

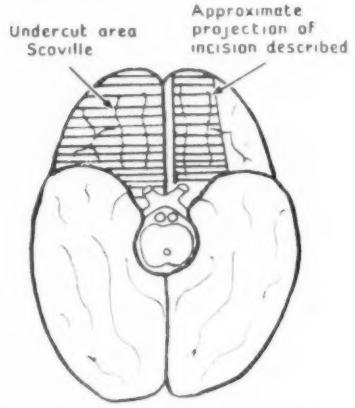

Fig. 1.—Diagrammatic representation showing, on the left, Scoville's operation and, on the right, the restricted orbital undercutting of a zone on the inner aspect of the orbital surface. (Reproduced from Knight and Tredgold, 1955, by kind permission.)

must be cut, at the point of concentration of the fibres below the pars frontalis of the internal capsule rather than outlying parts of the white matter towards the inferior frontal convolution.

The results indicate that there is a specific area which when cut produces maximum benefit. In 10 cases a first operation with a 5-cm cut failed, but a second operation extending the cut posteriorly for a further centimetre produced success in 6 (Fig. 2, A–A). In 5 cases of failed rostral leucotomy the rostral scar lay 2·5 cm from the frontal pole, sometimes at a level above the plane of our operational site which was undisturbed by the rostral cut (Fig. 2, B). A

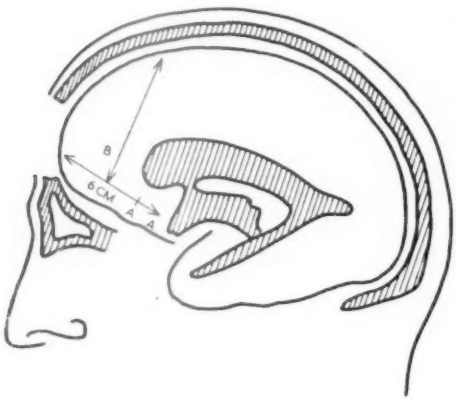

FIG. 2.—Diagrammatic representation showing A—A the posterior extension of the orbital incision at a second operation and, at B, the approximate site of the rostral scar. (Reproduced from Knight, 1959, by kind permission.)

routine incision extending behind the rostral scar relieved 4 of these patients. Division of fibres passing down from the pars frontalis of the internal capsule therefore plays an important part in producing improvement. There appears to be a concentration of fibres at this point, possibly concerned in primitive reactions since they are distributed to areas of polar cortex. Division of these fibres gives adequate relief of symptoms without the necessity of cutting across the substance of the lobe with a vertical incision, or disturbing fibres elsewhere in the brain. The technique of this restricted operation has been described elsewhere (Knight, 1959). With a butterfly incision following the receding edge of hair in balding patients, and with the bone discs moulded *in situ* with bone wax as well as bone dust, the site of operation is not detectable. The method has many advantages, avoiding the risk inherent in blind operations of an incision failing to reach its objective or its effect being extended beyond the appropriate plane by concealed hæmorrhage. The incision can be checked by definite landmarks permitting accurate operation in elderly patients in whom cortical atrophy is present. In one man of 65 with a twenty years' history of depression, the cortex lay 1 cm from the dura but a good result was obtained. Adequate hæmostasis can be secured and there is a noteworthy absence of undesirable sequelæ which sometimes complicate blind procedures as a result of an inaccurate cut or hæmorrhagic destruction.

The failure of previous psychiatric treatment, including electro-convulsive therapy, is no contraindication to operation. All our 330 patients have been treated by diverse psychiatric measures; some after twelve to twenty years have responded to operation within weeks or months. The duration of symptoms is therefore of little significance. Patients who respond well to electro-convulsive therapy and those who do not make equally good recoveries. Previous operations do not preclude the possibility of success for there is evidence that blind procedures at times fail to reach their objective (Table I).

TABLE I.—RESULTS OBTAINED BY RESTRICTED ORBITAL UNDERCUTTING IN PATIENTS PREVIOUSLY SUBJECTED TO UNSUCCESSFUL LEUCOTOMY OPERATIONS

Previous operations	No. of cases	Improved	Failed	Mortality
3 Prefrontals	1	1 obsessional		
2 Prefrontals	3	1 obsessional 1 schizophrenic	1 schizophrenic	
1 Prefrontal	8	1 obsessional 2 schizophrenic	4 schizophrenic	1
Transorbital	1	1 agitated depression		
Rostral closed	4	1 obsessional 2 depressive 1 anxiety state		
Rostral open	1		1 obsessional	
Total	18	11	6	1

Age is not a determining factor. In the absence of hypertension or other physical abnormalities success may be obtained in the 70–80 age group.

A woman aged 79 previously suffering from continual restless agitation owing to torturing sensations as if she were being eviscerated, being unable to sit still for a moment, showed cheerful composure and activity four days after operation. At the age of 82 she wrote that every day she lived was worth something. "I feel ten years younger and have got right back to what I was. I get a little giddy when I get

down on the floor but I do all my own work, shopping, and cooking, and do everything for myself. I am living by myself, perfectly happy in my 83rd year."

Results

330 patients have been treated by restricted orbital undercutting at Runwell Hospital and at the Regional Neurosurgical Centre at The Brook Hospital, all of whom have been personally studied both pre- and post-operatively.

TABLE II.—ANALYSIS OF OPERATIVE MORTALITY

		Early operative mortality
Total cases at December 1959:	329	1 Hypertensive. Status epilepticus
Second operation	10	1 Hypertensive hemiplegia
		1 Prefrontal leucotomy scar—intraventricular hæmorrhage
Total operations	339	3
		Delayed operative mortality
		1 Cerebral thrombosis. Onset 7th day
		1 Bronchopneumonia. Onset 12th day
Total mortality		5 (1·32%)

Two hypertensive patients died; one, who had had a previous stroke, died from a second one; another developed status epilepticus. This operation should not be performed in the presence of gross hypertension. In one re-operation on a tough infero-mesial scar involving the ventricle, reactionary hæmorrhage later produced an intraventricular clot. Under normal circumstances the mortality should be less than 1% (Table II). 248 cases have so far been analysed according to their pre-operative disablement and post-operative result (Tables III and IV).

The quality of recovery is high and in good personalities is often described as 100%. Defects of restraint are seldom if ever detectable even in minor degree. Most patients remain warm and normal emotionally. Intellectual change is never marked. Some patients are a little inclined to take things easily, which might be regarded as evidence of flattening, but psychological tests usually reveal an improved score.

A woman aged 25 whose emotional upsets were characterized by hostility and aggression, due to a feeling that the world was against her, completely repudiated emotional ties, had no affection for her son and only one of respect towards her husband. After operation she reported that she was definitely

TABLE III.—RESULTS CLASSIFIED ACCORDING TO PRE-OPERATIVE DISABLEMENT AND POST-OPERATIVE RESULTS

	No. of cases	Recovered	Improved, no psychiatric treatment, slight symptoms	Failed	Deteriorated	Mortality	Epilepsy
C. Psychiatrically disabled, i.e. out of hospital but in need of constant psychiatric help and treatment including drugs and E.C.T.	82	46	25	9	1	1 Hypertensive	4
B. Socially disabled, i.e. out of hospital but unable to work	55	37	10	7	—	1 Hypertensive	3
A. Totally disabled, i.e. in mental hospital	111	57	33	19	—	1 Cerebral thrombosis 1 Pneumonia	5
Total	248	140	68	35	1	4	12

TABLE IV.—POST-OPERATIVE RESULTS ANALYSED IN RELATION TO PRE-OPERATIVE STATUS AND TYPE OF PSYCHIATRIC ILLNESS

	Pre-operative status (*see* Table III)	Schizophrenia	Agitated depression, anxiety neurosis and tension states	Depression	Obsessional	Totals
Recovered ..	C	1	32	6	7	
	B	5	17	9	6	
	A	6	35	13	3	
Totals		12	84	28	16	140
Improved ..	C	1	16	3	5	
	B	2	6	1	1	
	A	13	14	4	2	
Totals		16	36	8	8	68
Failed ..	C	1	4	2	3	
	B	3	2	1	1	
	A	10*	4	3	2	
Totals		14	10	6	6	36

*Prefrontal leucotomy had been previously performed in certain of these cases.

more affectionate than she used to be and her family was happy in consequence.

Another patient, always terrified, with morbid fears of death, reported six years after operation that it was hard to believe that she was ever like that, she was working as a nurse in a mental hospital and she herself and her family showed such sunny serenity as to prove that her emotional recovery was complete.

The operation produces tranquillity and loss of fear in anxiety neuroses and undifferentiated tension states.

Mr. N. S. had lived since 1945 in constant fear of meeting people and was afraid of falling in the street; the mere thought of going anywhere made him perspire and tremble. He had not worked for years. The family lived on National Assistance and his wife's health had deteriorated from frustration. After operation in October 1955 he was going for short walks by May 1956. By 1957 he led a full and active life, *was enjoying work and leisure*, and earning an excellent living.

A young girl, referred as a ? schizophrenic, had made several suicidal attempts, and more than one spirited attempt to strangle the medical superintendent; under the influence of lysergic acid she literally bit and tore. An excellent relief of tension was obtained by operation. Patient rehabilitation and support was required for some time but she is now secretary to the manager of an important business; she has occasional days of depression but is usually a little manic and cheerfully works overtime unpaid, until late at night, against advice.

Ström-Olsen. Following operation in October 1956 she left hospital on December 12, remarkably relieved. She succeeded in running Christmas for her husband and family who regarded her recovery as being 100%. Letters from her husband describe her activities in running her house, instilling discipline into the children, driving her car, playing in tennis matches for her club and running a large garden, and enjoying an active holiday in the South of France.

Genuine distress can be relieved in hysterical personalities but great care is required in selecting these cases.

A woman of 62 with a life-long history of pain and a variety of other hypochondriacal symptoms, full of self-pity and inclined to histrionic display, complained of inability to walk. She was seen at a well-known clinic and considered to be incapable of living outside a mental hospital. Operation was performed in 1953, and in 1956 she reported that she had no pain anywhere, had gained commonsense independence, was better on her own and found life full of interest. She loved going to the theatre, and had got all her old interests back. "Before operation I wanted to do nothing, now I live to do all these things again."

Success has been obtained in drug addiction and alcoholism when the cause of this addiction has been escape from a tension situation, the patient seeking sedation by these means.

A young patient who had been thrown into prison in Spain on account of her behaviour was threatened

TABLE V.—POST-OPERATIVE RESULTS IN ENDOGENOUS PSYCHOTIC DEPRESSION (AGITATED DEPRESSION, DEPRESSIVE STUPOR, MELANCHOLIA)

Pre-operative status	No. of cases	Recovered	Improved, no psychiatric treatment, slight symptoms	Failed	Deteriorated	Mortality
C	42	28	10	2	1	1 Hypertensive
B	26	19	5	1	—	1 Hypertensive
A	61	43	12	6	—	—
Totals	129	90	27	9	1	2

The operation is of great value in psychotic depression which has resisted psychiatric treatment (Table V); in this group are included many florid examples of so-called melancholia and depressive stupor, exemplified by a patient who sawed off her right arm as a gesture of despair, and others whose symptoms had persisted for fifteen to twenty years.

A woman confined in a mental hospital for three years without spontaneous speech, if spoken to would only answer "I don't know, what is the use, I am dead". She sat huddled in a chair unable to remember where she lived or how many children she had, would not engage in any occupation, was convinced that she had practised witchcraft and that she died in 1953. She was seen in consultation by Dr.

with Certification for her own protection. Since operation in 1956 she has led a normal active life; she takes no drugs and can drink with restraint at parties. She states "I am in control of my emotions now, they used to be in control of me".

In schizophrenia, severely agitated or disturbed patients whose personality is well preserved respond well, and it is noteworthy that with the reduction of emotional tension delusional patterns and hallucinations may fade. Poverty of emotion is sometimes seen post-operatively as a feature of the schizophrenic personality in contrast to the normal emotion of other post-operative states.

A patient from South Africa who had been confined in Pietermaritzburg for seven years, often completely

intractable and vividly hallucinated, spoke sense to her relatives within two days of operation. After a period of three months during which she progressively outgrew stages of selfishness, argumentativeness and self-assertion, like a small child growing up, she derived great benefit when allowed to spend her time in shopping and travelling about town. Five months after operation she flew back to South Africa unaccompanied, obtained a post as secretary in a Government office which she has held satisfactorily at a time when others are being discharged for redundancy. Her father states that apart from a certain tendency to desire her own way, her recovery is complete.

Conclusions

There is evidence that the effect of operation depends upon the site of the lesion rather than its extent and that operation at this site does relieve certain of the more severe cases without the unfavourable personality defects left by the full standard operation. Since this operation can in certain cases succeed in relieving after a few weeks symptoms which have persisted for many years, there is a definite indication for its employment at an early stage in suitable resistant cases which have shown no sign of response to standard methods of treatment.

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Selective Leucotomy

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STANDARD prefrontal leucotomy demonstrated the value of surgery in some cases of mental illness and at the same time indicated the need for a more limited operation which would confer at least the same benefit but with far less risk of complications, both mental and physical. In planning new operations it seemed logical, with so many variables present, to perform them by an open method. In this way it was hoped that the lesion could be more accurately limited to the desired site without damage to other parts of the frontal lobe, and at the same time information possibly obtained on the function of the frontal lobes and the problem of specificity of function.

In the last eleven years we have concentrated on two such operations, orbital leucotomy and cingulectomy. The results are reported more fully elsewhere (Lewin, 1960).

Orbital Leucotomy

The choice of orbital leucotomy was determined by earlier clinical and experimental work on the orbital cortex which suggested that there was a close relationship between it and emotional disturbance: the observations of McLardy and Meyer (1949) that there was some advantage in isolating the orbital cortex and the favourable reports of Scoville's early cases (Scoville, 1949). We have followed his technique of open operation and have found it a very satisfactory procedure (Tow and Lewin, 1953). Indications for a favourable prognosis after operation have been the presence of a good personality before the illness began, and when the illness had been accompanied by some loss of weight. On the other hand the results were less satisfactory where there was a history of an inadequate or immature personality, or where there was a strong hysterical element. Indeed these two features were present in most of the failures, and in some the prospect of only a limited improvement was recognized at the time of operation on these accounts.

Of our 60 patients, some have now been followed for ten years after operation and all but four for at least two years. In describing the results it was thought advisable to avoid the words "recovered" or "cured", although such terms have been used by patients and their relatives on many occasions. Those patients classified as "greatly improved" are relieved of the symptoms from which they sought relief and are all at home and working. Similarly those patients classified as having obtained "some benefit" are undoubtedly much improved and most are at home. Patients who have not obtained substantial benefit have been classified as "unimproved". Less than this would not justify operation.

Results in psychotic illnesses.—Of 24 patients who underwent orbital leucotomy, 6 were greatly improved and 9 derived benefit of whom 6 returned home, an overall improvement of 15 among the 24 cases. Although surgery is not a cure for schizophrenia, orbital leucotomy can give at least as much benefit as the standard leucotomy and without the major complications associated with that operation. But one should note not only the total number improved but that 4 of the schizophrenic patients were so

much improved after operation as to be considered by some to be cured. As long as some patients benefit there will always be a demand for operation in an otherwise unremitting illness. It is therefore necessary to look not only for the particular symptoms within the illness likely to be benefited by operation but to evaluate the successfully treated patients to determine what other factors were present to effect a good prognosis. In these particular patients who did so well it may be significant that they did not have the typical schizophrenic build, and that prior to the illness they had had a good affect and had been well adjusted.

Results in affective disorders.—Of 36 such patients undergoing orbital leucotomy, 18 were greatly improved and 11 were benefited, giving an overall improvement in 29 of the 36 patients. In many of the patients classified as "greatly improved" it is almost pardonable to speak of cure since all the symptoms of depression or anxiety present before the operation have gone and the patients are back to a normal life. The improvement was seen soon after operation and proceeded rapidly over the next weeks and months. Particularly impressive were the results in older patients with depressive illnesses. The satisfactory outcome of 3 female patients with anorexia nervosa should also be noted.

Complications.—There have fortunately been no complications in this series, no operative deaths and no major metabolic disturbance or gross personality change. Intellectual tests after operation have shown no significant impairment. But some personality changes do follow, although mild and much less than after the standard cut. Thus the patients have reported that they tend to tire more easily and their ability to plan ahead is not as good as in the past. Some of the housewives have noticed that although their housekeeping is accurate it takes them longer to do.

The incidence of epilepsy was 8% but it should be noted that of the 5 patients in this series of 60 who had a fit after operation, in 2 it was a single episode only and the other 3 patients either had had a fit before operation or a pre-operative EEG had shown a frankly epileptic record. The risk therefore of major epilepsy after this operation seems to be small.

Cingulectomy

Experimental ablation of the cingulate gyrus in monkeys resulted in lessening of aggression and increased tameness (Smith, 1944, 1945; Ward, 1948; Glees *et al.*, 1950). In 1948 anterior cingulectomy was begun in a series of schizophrenic patients in whom leucotomy had been advised. It was hoped that the more limited operation might prove effective but most of the patients relapsed after a few months. It was, however, significant that those patients with marked obsessional features obtained some relief and similarly those with marked aggressive behaviour were also improved (Whitty *et al.*, 1952.) Therefore, although the operation was abandoned for major psychosis, it was continued for psychoneurotic disorders, particularly for obsessional neurosis and those patients with anxiety or depression with marked obsessional features. The results in this group have proved encouraging.

The operation is a truly limited one but involves a frontal osteoplastic flap. The anterior part of the cingulate gyrus on each side about 4 cm in length is removed leaving intact the anterior cerebral arteries running between them, and the rest of the frontal lobes undisturbed. In 26 patients, 21 derived definite benefit, of whom 11 had a very good result. In patients with obsessional neurosis, many of whom had been ill for years, the effects of operation were particularly satisfactory. Personality changes after this operation were small, less than those after orbital leucotomy (Tow and Whitty, 1953). This was particularly important in patients who were architects, undergraduates and teachers wishing to return to their work. The results of cingulectomy in cases of obsessional neurosis seem favourable compared with those of other limited operations. Thus less than half of such patients are reported improved after orbital or rostral leucotomy. Indeed the only operation giving comparable results is the standard leucotomy but at too high a cost, certainly, as a first procedure.

Following reports by Le Beau (1952), cingulectomy has also been performed for aggressive states, some in epileptic patients. Our results, 5 of 7 greatly improved and the other 2 benefited, confirm his observations.

More patients were incontinent in the post-operative period after cingulectomy than after orbital leucotomy. This is expected because of the relation between the autonomic nervous system and the cingulate gyrus. In all patients it was temporary and cleared within a few days.

Conclusions

The early years of psychosurgery demonstrated that operation on the frontal lobes could relieve mental illness. This symposium takes place at an appropriate time when the results of the second phase of surgery are being assessed—the attempt to find limited operations on the frontal lobes which confer at least the same benefit but without the major physical and mental complications seen with the standard prefrontal leucotomy.

At this stage certain conclusions seem justified. It is generally agreed that leucotomy is no cure for psychotic illnesses and is helpful only in so far as it may alleviate particular symptoms, mainly those of tension and aggression. The results of orbital leucotomy in psychotic states suggest that at least the same proportion and degree of relief can be obtained as with the older standard operation and the stage is now reached where blind prefrontal leucotomy should be abandoned.

The second conclusion is that selective leucotomy can give very satisfactory results in severe and long-standing anxiety and depressive states and in obsessional neurosis. I prefer orbital leucotomy for depressive illnesses and cingulectomy for obsessional neurosis and for some aggressive states.

We are now at the outset of the third stage in the surgery of mental illness. It is probable that with the earlier recognition and more active treatment of mental illness in the future, we shall see less of the chronic illnesses which in the past have come to surgery. Moreover early diagnosis may make response to the simpler forms of treatment more effective. Where these fail the psychiatrist has a wealth of therapeutic tools at his disposal including electrical treatment, the newer drugs such as the mono-amine oxidase inhibitors, and selective leucotomy. That fewer patients will need surgery in the future may be true. But in our present state of knowledge it would appear that there will still be some patients whose response to other medical measures will be disappointing or inadequate, and here selective leucotomy may cut short a distressing illness and should not be too long delayed. This third period opens, therefore, with good therapeutic promise and with the opportunity of a critical appraisal of various methods of treatment in the relief of mental suffering.

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Orbital Undercutting and Cingulectomy—A Psychiatric Appraisal

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Frequency of Operations

Between 1949 and 1958 there were 2,557 admissions to the Warneford Hospital, Oxford, and during that period 37 patients were subjected to selective cerebral surgery. The number of patients operated on compared with the number of admissions provides a convenient index of the frequency with which selective surgery is used. This ratio is approximately 1·5% and yearly variations are insignificant (Table I).

Table I.—Frequency of Cerebral Surgery from 1949–1958 (The Warneford Hospital)

	Total admissions	Cingulectomy	Orbital undercut	Patients	Percentage of admissions
1949	137	1	0	1	0·73
1950	163	3	1	4	2·45
1951	226	1	1	2	0·88
1952	214	0	2	2	0·93
1953	248	1	5	6	2·42
1954	252	0	1	1	0·40
1955	229	1	6	7	0·31
1956	333	2	1	3	0·90
1957	375	1	4	5	1·33
1958	380	5	1	6	1·58
Total	2,557	15	22	37	1·45

Clinical Material and Outcome

13 men and 24 women were operated on—all by Mr. Walpole Lewin—at the Radcliffe Infirmary, Oxford, to which they were temporarily transferred for a period of seven to ten days. 26 of the patients were under the psychiatric care of Dr. R. G. McInnes and 11 were under my care. The ages of the patients, at operation, ranged from 17 to 77 years, 18 of them were under 35 years, 19 were 35 or over.

The diagnosis and length of stay of each patient in the Warneford Hospital before and after orbital undercutting is shown for men in Fig. 1, and for women in Fig. 2. Two points emerge: (1) Length of stay before operation has little influence on outcome. Some patients had already been in other hospitals. (2) As judged by length of post-operative stay lasting one year or more, there were 5 failures out of the 24 patients in this group. Some patients went on to other hospitals.

The cingulectomy group is shown in Fig. 3. By the same criterion as was applied to the orbital undercut group there may appear to be only 2 failures among the 15 cingulectomy patients; but two of them who were clinically judged failures after post-operative stays of 278 days and 325 days respectively were then submitted to orbital undercutting, and they appear also in Fig. 1 and Fig. 2. Both of them were

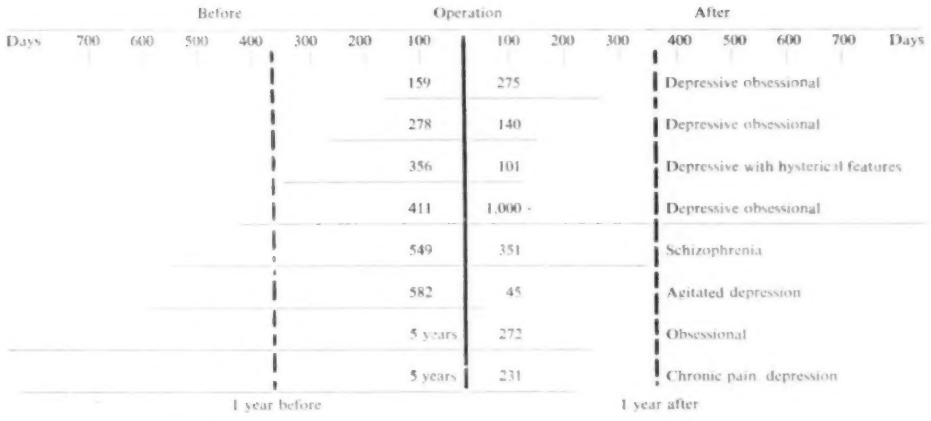

FIG. 1.—Length of stay in hospital before and after orbital undercutting (men).

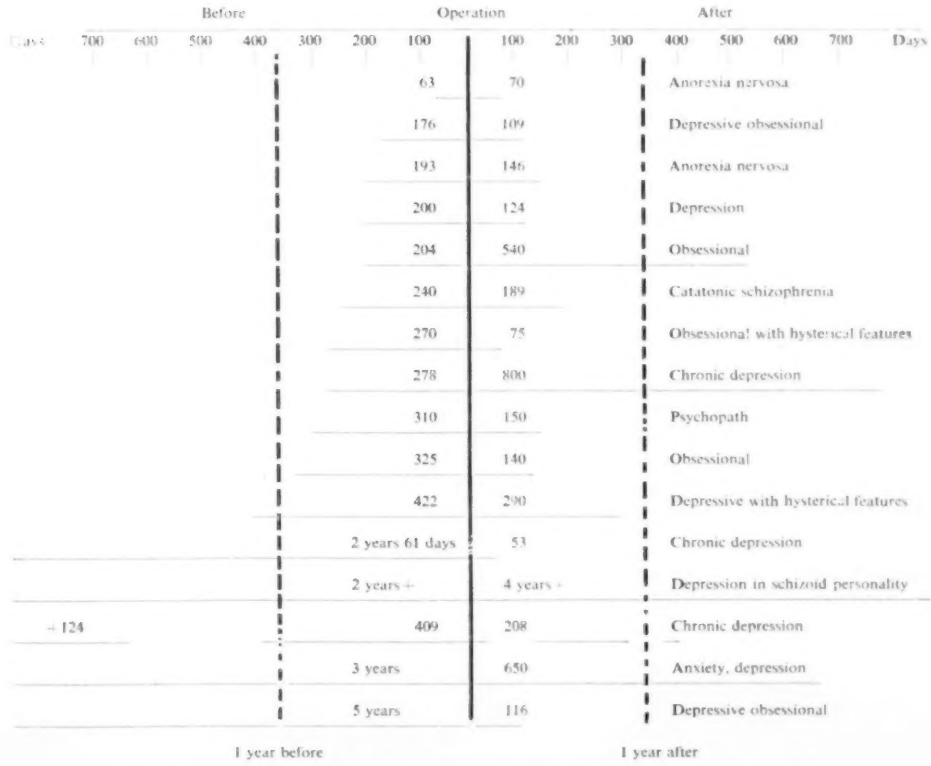

FIG. 2.—Length of stay in hospital before and after orbital undercutting (women).

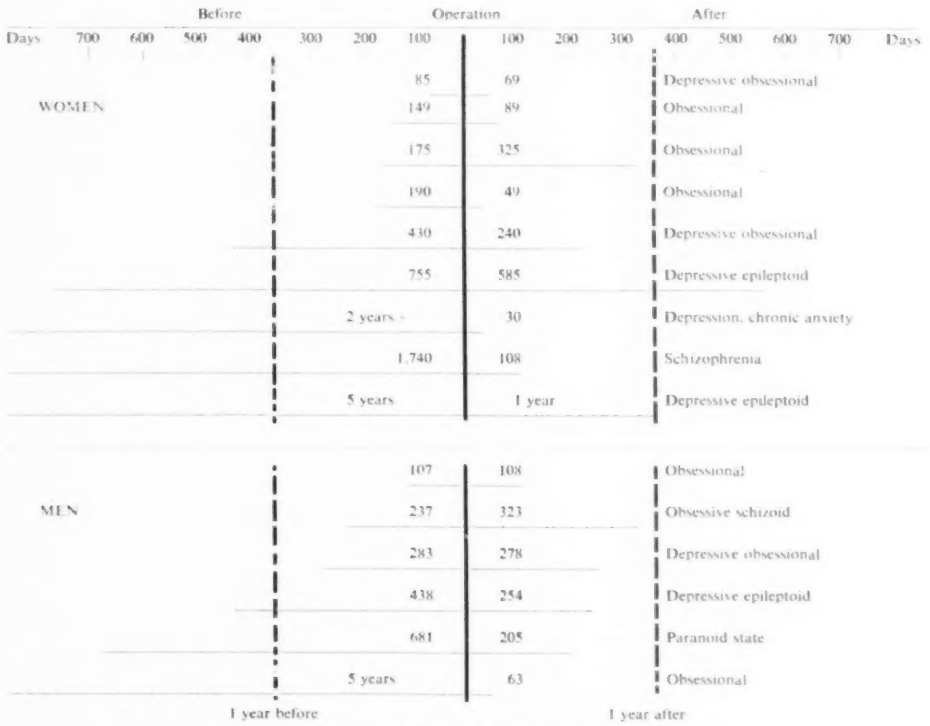

FIG. 3.—Length of stay in hospital before and after cingulectomy.

accounted successes in the end. The failures after cingulectomy are therefore 4 out of 15.

The median length of stay after cingulectomy was 205 days (230 days for the 6 men, 108 days for the 9 women); after orbital undercutting the median length of stay was 208 days (272 days for the 8 men, 148 days for the 16 women).

All of the 37 patients had had other forms of treatment, including in the later years tranquillizers (but not mono-amine oxidase inhibitors), but none had shown more than transient benefit. There was little reason to expect spontaneous recovery in these patients during the time recorded, and most of them were justifiably regarded as likely to require institutional care for an indefinite period. Yet when this group was reviewed at the end of 1959, 30 of the 37 patients had returned to the community, though some still had a residue of symptoms requiring medical attention from time to time.

11 patients were fully restored and symptom free. The occupations to which they returned vary from the successful pursuit of undergraduate and professional careers to the relatively no less exacting tasks of running a home and being the mother of a young family. Clinically, occupationally and socially, Dr. McInnes and I have not observed any impairment of personality or intellectual functioning as a consequence of the operations.

One patient died of cancer at the age of 79, two years after operation, and another, after a similar period, died of coronary occlusion at the age of 72.

Selection of Patients for Operation

There is no particular relationship between diagnosis and operation. Diagnoses of individual patients can be seen in Figs. 1, 2 and 3. In both the orbital undercut and the cingulectomy groups, most of the patients were suffering from depressive-anxiety-obsessional syndromes, the prominence of each of these components varying from patient to patient. The orbital undercut group included two cases of anorexia nervosa, one catatonic schizophrenic and one compulsively self-mutilating psychopath. The cingulectomy group included three dysrhythmic personality disorders, one schizophrenic and one chronic paranoid state.

Many patients with similar diagnoses do not come to operation, yet some of them recover.

There is no single symptom or clinical feature which consistently appears in the successful cases. In the unsuccessful cases, however, there were a number of personality anomalies in addition to the formal immediate syndrome. The most common feature pointing towards operation and a favourable outcome was the element of pent-up emotion, whether in the form of the persistent tension of the anxious obsessional depressives or the temporarily controlled but simmering aggressiveness preceding the paroxysms of disordered behaviour in some of the other patients. But operation may be successful in patients who do not exhibit these features. 2 of the patients (one anorexia nervosa and one catatonic schizophrenic) were devoid of emotional display yet they both had successful outcomes.

The indications for operation, though inconstant, become plain as the natural history and course of each patient's illness unfolds. Suitable patients are those who, regardless of the duration of the illness, have not deteriorated in personality, are free from relevant progressive organic disease, have been expected to respond favourably to other treatments but have not in fact done so, and continue to be distressed or disabled, persistently or intermittently. They are aware of their sufferings and at least at times have good general insight. They want to get well and are prepared to submit to major cranial surgery, after its nature has been explained to them, with no guarantee of success but with a reasonable chance of relief.

Conclusion

Orbital undercutting and cingulectomy are worth-while procedures in psychiatric treatment. The extent to which they can be utilized is limited, but their value to the selected patient is in our experience great. Such treatment is not always the end of the therapeutic story. Some of our patients needed E.C.T. and tranquillizers after operation as well as before it; but it made the first discernible impact on an otherwise intractable illness in most of the patients in this group.

The introduction of tranquillizers in the later years of the period under review has not diminished the need for selective surgery, as can be seen from Table I. It remains to be seen whether the more recently introduced monoamine oxidase inhibitors will do so—there are some grounds for thinking that they will, at least in relapsing depressive patients.

I acknowledge gratefully the help of Dr. R. G. McInnes in preparing this paper and that of Dr. R. W. Parnell and his staff in the Research Department at the Warneford Hospital, who devised and produced the Table and Figures.

Pathological and Anatomical Aspects of Orbital Undercutting

By Elisabeth Beck
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and J. A. N. Corsellis
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In contrast to the many brains subjected to leucotomy operations now available for pathological and anatomical investigation, post-mortem material from the more selective types of operation, such as orbital undercutting, is scarce.

The following is a report on autopsy material from 5 such cases. In 2 patients, one of Dr. J. Le Beau's and one of Dr. W. B. Scoville's, the operation had been done for intractable pain, while a further 3, psychotic patients, had been operated on by Mr. D. W. C. Northfield. The length of survival was from two and a half months to two and a half years. In one, death was attributed to the effects of the operation, which had been carried out five and a half months earlier; in the remaining 4 death was due to malignant disease.

Serially cut coronal sections were prepared and stained at regular frequent intervals leading from the site of the original lesion through the entire diencephalon to the pons. First, the appearance and exact extent of the surgical lesions themselves and, second, those fibre pathways that had degenerated as a result of the lesions were examined.

At operation entry had been made through horizontal slits in the frontal pole up to 2·5 cm across. The vertical extent ranged from 0·5 to 2·5 cm.

Coronal cuts through the frontal lobes showed the lesions to lie transversely in the white matter deep to either the more medial part or to the whole of the orbital cortex. The level illustrated in Fig. 1 is that of a coronal cut 4 cm behind the pole and through the tips of the anterior horns. At a level 1 cm more posteriorly the lesions have begun to die out, only a small slit being found lying between the striatum and the orbital cortex (Fig. 2).

The finding therefore in most hemispheres has been a complete undercutting of the orbital cortex in the antero-posterior plane, to a depth of about 5·5 cm. The transverse or mediolateral extent has been more variable, sometimes the entire orbital surface being affected, at others only the medial half. At times the lesions were associated with some degree of cortical damage apart from that at the point of entry.

The tracing of the degenerated pathways involved examination of the afferent connexions

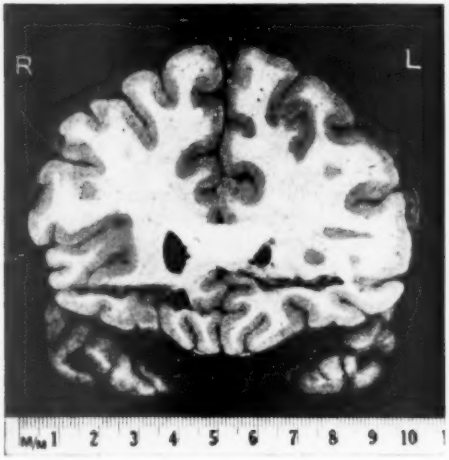


FIG. 1.—Coronal cut 4 cm behind the frontal pole to show the undercutting of the orbital cortex.

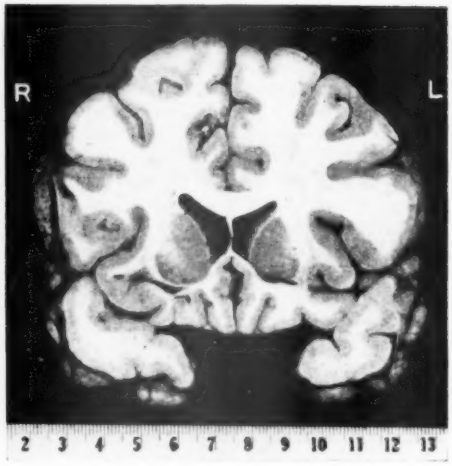


FIG. 2.—Coronal cut 5 cm behind the frontal pole, the lesions now appearing as small slits between the striatum and the orbital cortex on each side.

from the thalamus, the efferent connexions to the hypothalamus, and the long association and projection tracts.

(1) The thalamus: the main afferent connexion to the orbital cortex comes from the medial portion of the dorsomedial nucleus. In all 5 cases this showed severe retrograde changes with much loss of nerve cells and a dense gliosis (Fig. 3). The degenerated area was a large one and indicated the comparatively strong projection to the orbital surface compared with that to the rest of the prefrontal cortex. This interesting finding was postulated by Meyer and Beck in 1945 and more recently by Yakovlev (1954). The degenerated tract projecting from the dorsomedial nucleus can be followed forwards in the most ventral fibre bundles of the anterior limb of the internal capsule as far as the most rostral limits of the head of the caudate nucleus.

(2) In the hypothalamus the problem is a different one, being a question of tracing the long-term effects of damage to cortico-efferent fibres. Such damage leads to transneuronal degeneration in which the nerve cells often do not disappear but only shrink and show pyknotic nuclei and the glial reaction is less striking. Although such subtle changes can be recognized in cases with bilateral lesions, they are more striking in unilateral cases, since the unaffected side then acts as a control. We have added such a case to the series, in which an old injury had almost selectively damaged the orbital region. The findings in this case corresponded to those seen bilaterally in the orbital undercutting cases and were essentially confined to the mammillary body. On the affected side the medial mammillary nucleus was smaller throughout, there

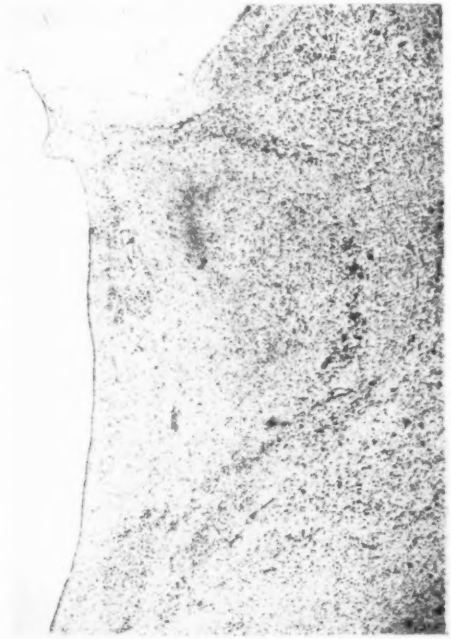
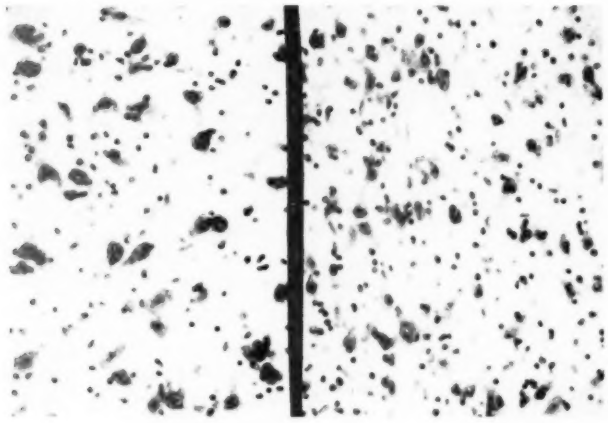
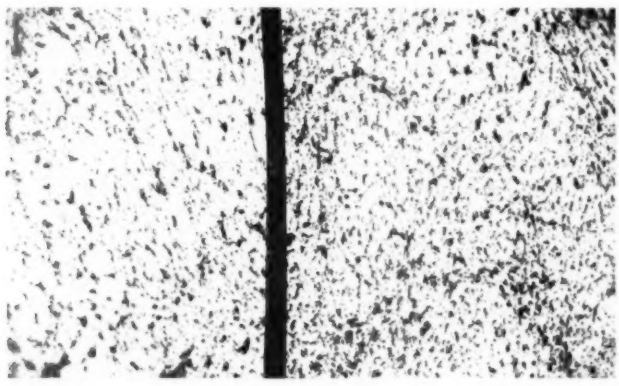


FIG. 3.—The dorsomedial nucleus of the thalamus showing a patch of nerve cell loss and dense gliosis in the upper medial quadrant. Nissl stain. × 13.



A B

FIG. 4.—A, Appearance of the medial mammillary nucleus on the normal side to compare with B, the affected side in which most of the nerve cells are shrunken and there is a moderate gliosis. Nissl stain. × 225.



A B

FIG. 5.—A, Appearance of the fornix as it enters the mammillary body on the normal side to compare with B, the heavily gliosed fornix on the affected side. Nissl stain. × 60.

was some loss and considerable shrinkage of nerve cells and an increase of glial cells (Fig. 4). Considerable gliosis was also present in the fornix of the affected side as it entered the mammillary body (Fig. 5). Since the fornix in its entire course was otherwise intact this suggests that an orbito-hypothalamic connexion may join the bundle at this point. The existence of such a connexion had been postulated by Beck, Meyer and Le Beau in 1951. Changes comparable to those seen in the medial mammillary nuclei were not seen in any of the other hypothalamic centres.

(3) With regard to the long association tracts, the uncinate fasciculus running between the orbital and the temporal areas was always degenerated, and the same was also true of the long projection tract, the fronto-pontine.

The small number of cases as well as their nature does not allow conclusions to be drawn about the clinical results of the operation in relation to the pathological findings. There are, however, two points that may be usefully mentioned in relation to the operation itself. First, although McLardy's (1950) suggestion that bilateral damage to posterior orbital cortex might cause death from uræmia was not con-

firmed in our cases, evidence was found in one case to agree with his conclusion that bilateral damage to the striatum might lead to death from "trophic deterioration". Secondly, as Meyer and Beck (1954) have pointed out, the position of the thalamo-frontal projection in relation to the undercutting should be noted. That is to say, if the cut should tend to move only a little too far dorsally fibres destined to reach the frontal convexity, as well as those going to the orbital areas, would also be involved.

If therefore the aim (or one of the aims) of the operation is to sever selectively the thalamic projection to the orbital cortex, while sparing that to the convexity, this may not always be achieved.

Acknowledgments.—We are deeply indebted to Professor Alfred Meyer for much help and advice in this work.

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The Past and the Future

By D. W. C. NORTHFIELD, M.S.
London

Orbital undercutting provides a valuable method of relieving symptoms in selected cases of mental disturbance with the risk of only slight personality disorder. I do not wish therefore to speak further in its support, though that does not imply that I do not think the operation a good one; I have often performed the operation with similar beneficial results. But I would like briefly to scan the past and then the future. It is roughly a quarter of a century since the operation of leucotomy was introduced; within the second half of that period the Scoville operation has been introduced and has gradually gained favour so that the original leucotomy technique is now rarely practised, and is likely completely to be discarded in favour of the more selective techniques. I have been particularly impressed by the beautiful preparations of Dr. Corsellis and Mrs. Beck: in particular, the demonstration of degenerated fibre tracts grouped together just in front of the tip of the frontal horn. The introduction of stereotaxic surgery now provides a more elegant method of selective surgery, namely the interruption of these fibres in this strategic position where they are grouped together. During the coming years this type of operation may replace orbital undercutting by present methods, with similar or even better results. Looking further ahead I suspect that surgery will be eventually displaced by drug treatment. Dr. Skottowe stated that in his experience the new drugs of tranquillizing type had not diminished the need for surgery. I do not think that the chemists will remain idle, and medical therapeutic advances may well relieve the surgeon of this field of activity. Indeed, I feel bold enough to suggest that in another quarter of a century the surgery of mental disorder will no longer exist; this meeting may prove to be a historic one, the last in this building in which this subject is presented for review and discussion.

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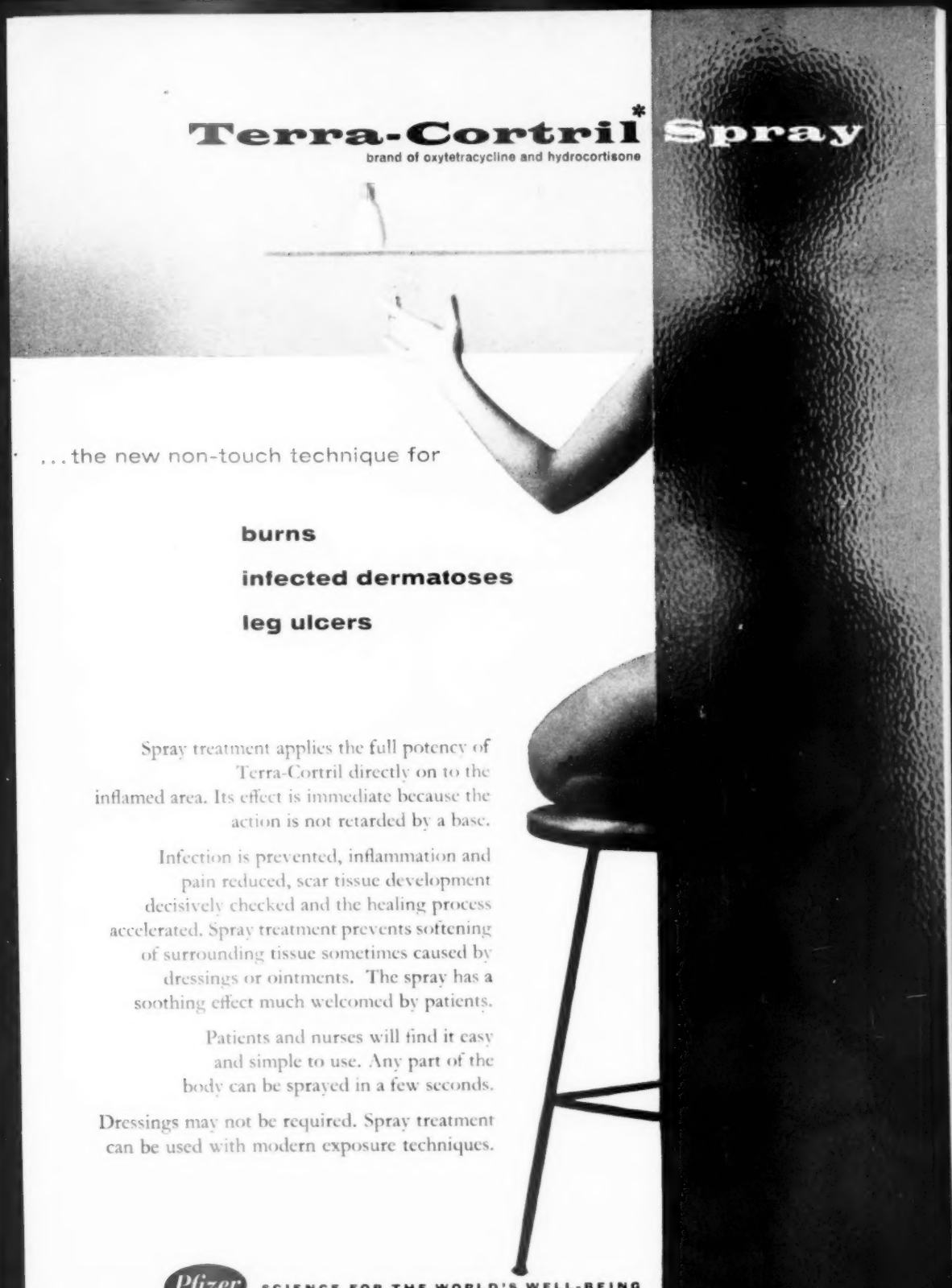

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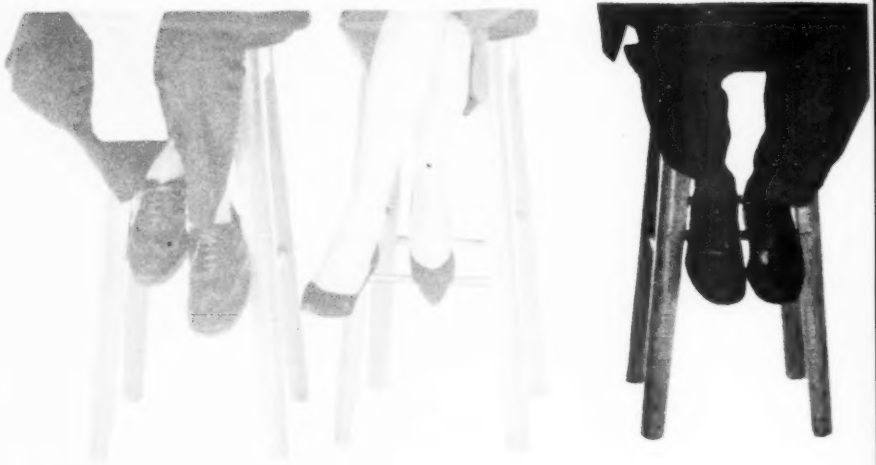

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Meeting
April 28, 1960

Treatment of Bladder Tumours

By J. C. ANDERSON, O.B.E., T.D., F.R.C.S.
Sheffield

BETWEEN 1947 and the beginning of June 1958 I assessed and treated 778 patients with bladder tumour. I wish to emphasize the fact that this is a personal series and I have been responsible for the pre-operative, operative and post-operative management. I admit to having included one patient whom I assessed and upon whom Mr. D. S. Poole-Wilson operated. No patients treated since June 1958 have been included, so that every one reported as being alive has survived for a minimum period of two years since the initial treatment. We have been able to trace 771, all but 7 of these patients. Since June 1958 I have treated a further 140 patients.

Prior to 1947 general practitioners had little confidence in treatment of cancer of the bladder, and delayed sending patients to hospital. This resulted in an undue proportion of advanced and hopeless conditions in the early days. As doctors have come to realize that modern treatment, including high voltage therapy, has something to offer we have been inundated from a wide area. Perhaps we were unwise to accept all or give anything other than a palliative dose to many, but we accepted and tried to treat every patient. Indeed, many died within a few weeks, even days, of being seen by me for the first time. All special clinics get an undue proportion of difficult cases, many of them from other surgeons, who continue to treat earlier and simpler conditions, and although I probably get a true sample of bladder tumours from the City of Sheffield and its immediate environs, I receive problems only from the more remote areas, so my figures are unbalanced.

I am sure that to begin with we were too conservative in our treatment by irradiation and dosage was on the low side, but we have had few, if any, cases of over-dosage with its dreadful sequelæ. I can only remember 4 examples of persistent hæmorrhage. With experience we have become more accurate in the assessment of the stage and character of the growth, and treatment has been better selected and directed with an improvement in results. With this improvement general practitioners have sent patients earlier, and I hope that results in the next ten-year series will be better than those now presented.

If present methods of treatment are to yield better results we must get cases earlier. I admit that there has not been much gross delay in the patient going to the doctor or in the doctor sending the patient to hospital, but when these two factors are added together there are instances of delays of a year or longer before the patient is treated. For better results the patient should be sent for investigation as soon as possible after the first symptom, and this is not always hæmaturia. Also, in each area someone should be interested in cancer of the bladder and gain experience in the assessment and treatment of all aspects of this disease.

In my series there are only 5 recognized industrial cases.

I am impressed by the accuracy of cystoscopic and clinical assessment. For example, in two instances I diagnosed carcinoma of the bladder, but when these bladders were opened I could not find any lesion despite careful search and, in one instance, removal of a piece of the bladder wall for section; yet within a period of about a year both were proved to have carcinomatous lesions at the site that I had originally suspected. If anything, cystoscopic and clinical assessment is an under-assessment. Sometimes it is difficult to decide whether a case is inflammatory or neoplastic: I have had two cases of tubercle (one in a man of 63) which at first were thought to be malignant; on the other hand, there have been tumour cases that I thought might be tuberculous, and there was undue delay whilst the urine was submitted to guinea-pig inoculation. I stress the difficulty in diagnosing cases of carcinoma of the bladder that resemble Paget's disease of the breast, wherein there is intramural spread with "eczema" of the epithelial lining of the bladder. In an appreciable number of cases the subsequent history and fate of the patient prove that

the cystoscopic assessment of stage and even of grade is more accurate than the histological examination. For instance, there are several cases where the appearance has suggested a papillary differentiated carcinoma that has begun to infiltrate, the histologist has failed to detect evidence of malignancy, and yet the clinical diagnosis was right. Pathologists should be less medico-legally minded in their reports, and give more positive and detailed information about the histology of these tumours. I believe that so-called benign papillomata are potentially malignant and given time they acquire undoubted malignant characteristics.

The excretory urogram may be very helpful in determining the stage of a lesion, but I would exclude this assessment from my series, because I was not fully aware of this at first, and some patients were not X-rayed. Also, our films are destroyed after seven years unless there is a request to the contrary, so I have not had time or opportunity to reassess every case by re-examining the films. I now attempt to stage each tumour from its X-ray appearance.

One cystoscopic appearance is misleading: I call it "honey-combing" and it appears after all kinds of treatment. It resembles a diffuse creeping papillomatous lesion, but if the fronds are closely examined, it is obvious that they are tiny vesicles. If they are treated with diathermy, they reappear. The lesion does not spread and it may persist unchanged for years. I believe it is due to lymphatic obstruction resulting from treatment. Another rare appearance that is misleading is that in which a large prostate produces bullous œdema around the bladder neck; this may occur in some cases of benign enlargement, possibly complicated by an inflammatory episode.

After irradiation the process of resolution may go for as long as nine months, and it is dangerous to meddle with the lesion within six months of the initial treatment. If it is diathermized, a painful, indolent ulcer may result. After interstitial or external irradiation there is nothing to be gained by cystoscoping the patient in less than five months, whilst the bladder is inflamed and irritable. Again I stress the importance of inserting a good volume implant when interstitial irradiation is employed.

Five years ago we started cytological examination of the urinary deposit. This proved of value and is now used in every case, but the figures in this series are confined to the earlier examinations, which were less reliable than at present. Doctors in the dye industry have rightly drawn attention to the fact that a stone in the urinary tract will produce a false positive result in such examinations.

There is evidence of urinary stagnation from prostatic enlargement, urethral stricture and diverticula of the bladder in many cases and the presence of such lesions may influence choice of treatment.

It is important to maintain contact with every patient and carry out a cystoscopic follow-up periodically for many years. Single papillomata may appear to be destroyed, yet several years later others appear in the bladder and these are not always as simple as the primary lesion. I see many patients who have been treated and presumably discharged from other clinics, who have developed other lesions, and sometimes our patients cease to attend after the primary treatment, and return several years later with infiltrating carcinomas. We have many instances of change in stage and grade with the passage of years, and have at least one patient with two different grades of tumour co-existent in the bladder.

On four occasions, one a few weeks ago, I have been driven to perform cystectomy after irradiation because of intractable bleeding from the bladder wall.

There are few cases of secondary deposits of tumour in the abdominal wall. I can recollect only three.

It is difficult to compare different methods of treatment, because I have criteria that I apply to each growth before I select appropriate treatment. For instance, I may employ as the primary treatment either excision and interstitial irradiation, or high voltage irradiation from an external source in Stage I, II or III growths, but the growth will be quite different in each instance. Taking Stage I, I would use excision and interstitial irradiation when the lesion is single, or if there were few or closely aggregated multiple lesions that could be easily excised, whereas I would employ external irradiation if the lesions were grossly multiple and widely distributed. In Stage III I would employ excision and interstitial irradiation when I could excise the growth and insert a volume implant adequate in dose and in distribution. The growth might be 5 cm in diameter on the vault, or 4 cm or less on the base. If it were not possible to excise the lesion or insert an adequate volume implant, then I would employ high voltage irradiation, but

the prognosis would in all probability be worse with a large growth.

Briefly, for as long as possible I control superficial lesions by cystoscopic diathermy, then I resort to excision combined with interstitial irradiation, in the belief that the irradiation is more accurately applied both in dose and direction by this method. When this is not possible, or when it has failed, I resort to high voltage irradiation from an external source, and finally, to diversion of the urine and cystectomy. From this it is evident that it is well-nigh impossible to compare results from different methods of treatment.

The following are a few interesting features that I noted during my survey:

3 patients had sarcoma of the bladder.

1 patient had 3 tumours in the bladder—2 anaplastic, 1 papillary differentiated.

1 woman with endometrioma of the bladder.

1 case of leukoplakia.

5 cases of carcinoma of the seminal vesicles.

3 patients had a papilloma or carcinoma of the ureter.

16 of the patients also had papillomata in the posterior urethra.

56 patients had papillomata in the posterior urethra, the bladder being unaffected.

1 patient had a papilloma in a diverticulum of the bladder.

1 patient had a carcinoma in a diverticulum of the bladder.

In 5 patients the disease was thought to be occupational.

59 patients had a prostatectomy at the primary operation with no ill effects.

14 ureters were cut at operation and sutured to the bladder.

23 ureters were known to be cut and were not sutured. No kidney was removed subsequent to this, and none has renal symptoms. 1 patient died of coronary occlusion and at post-mortem there was no extravasation of urine from the divided ureter.

95 patients with carcinoma of the bladder had a carcinoma at other sites which was regarded as being primary and not secondary:

Lung	19
Stomach	5
Bowel and rectum	9
Breast	6
Uterus	9
Elsewhere in genito-urinary tract	27
Miscellaneous and unknown sites	26

Of these 95 patients, 5 patients had carcinoma at 2 or 3 sites in addition to carcinoma of bladder:

(1) Lung and uterus.

(2) Lung and rectum.

(3) Renal pelvis and lumbar spine.

(4) Kidney and brain.

(5) Right breast, left breast and rectum.

These additional lesions are also included in the list above.

68 patients had 91 intimate relatives who had carcinoma, and of these 22 had lesions in the urinary tract. The existence of carcinoma in 91 relatives may not be significant, but the 22 urinary tract lesions may be.

I use the classification of the Institute of Urology.

In Table I the assessment of stage, clinical and histological, is compared. When they differ the clinical assessment is not necessarily wrong. If, in the clinical assessment, 3% of Stage II tumours are allotted to Stage I and 3% to Stage III, the clinical and histological figures are about the same. This lends some support to my belief that clinical assessment of stage is reasonably accurate and I have used it.

TABLE I.—CLINICAL AND HISTOLOGICAL ASSESSMENT OF STAGE

	Clinical		Histological	
	No.	%	No.	%
Not staged	—	—	313	—
Stage I	347	44·6	228	49·0
Stage II	219	28·2	100	21·5
Stage III	127	16·3	91	19·6
Stage IV	85	10·9	46	9·9
	778		778	

In Table II grade is assessed by various methods, but the results are not truly comparable,

TABLE II.—GRADE ASSESSED BY VARIOUS METHODS

	Clinical		Cytological		Fragment		Specimen	
	No.	%	No.	%	No.	%	No.	%
Not graded	—		23	—	13	—	2	—
Papillomata	275	35·5	46	34·6	109	48·9	70	20·4
Papillary differentiated	199	25·6	54	40·6	60	26·9	106	30·9
Papillary anaplastic	11	1·4	5	3·8	5	2·2	36	10·5
Solid differentiated	2	0·3	1	0·8	1	0·4	3	0·9
Solid anaplastic	187	24·2	21	15·8	23	10·3	60	17·5
Papillary and solid	101	13·0	1	0·8	9	4·0	22	6·4
Squamous carcinoma	1	0·1	5	3·8	14	6·3	42	12·2
Adenocarcinoma	—		—		2	0·9	4	1·2
Indefinite	1	—	81	—	13	—	6	—
No histology	1	—	541	—	529	—	427	—
Total	778		778		778		778	

because an undue number of fragments are obtained from papillomata, and a large number of papillary differentiated tumours are excised prior to the insertion of radon seeds and they yield specimens for histology. The clinical assessment seems to be intermediate and I believe that it can be used with a fair degree of accuracy to grade the tumours as papilloma, papillary differentiated or solid tumours.

Table III enumerates survivors, related and unrelated deaths and sex. Bladder tumours are commoner in males; women escape death from other causes to die of this disease.

TABLE III

Cause of Death

Alive		Related		Unrelated		Fate unknown	
No.	%	No.	%	No.	%	No.	%
350	45·4	274	35·4	147	19·2	7	—

Sex

Males		Females	
No.	%	No.	%
574	73·8	204	26·2

Cause of Death related to Sex

	Alive		Related		Unrelated		Fate unknown	
	No.	%	No.	%	No.	%	No.	%
Males ..	254	44·3	197	34·3	118	20·6	5	0·9
Females ..	96	47·0	77	37·8	29	14·2	2	0·9

From the material presented in Table IV I found that after all methods of treatment a lesion persists in the bladder in 10% of the survivors.

TABLE IV.—TREATED PATIENTS WHO ARE ALIVE AND WELL OR ALIVE WITH RECURRENCES

Treatment	Total patients	Alive and well		Alive with recurrence	
		No.	%	No.	%
Cystoscopic diathermy ..	259	169	65·3	16	6·2
II. Interstitial radon with or without surgery ..	140	77	55	7	5
III. Supervoltage X-ray therapy (S.X.R.) including combined interstitial radon and S.X.R., inter-uterine radium, vaginal radium and S.X.R.	263	53	20·2	6	2·3

The condition of the bladder in those dying of other diseases was studied and I found that where the state of the bladder at the time of death was known 10% had persisting disease, but the state of the bladder was unknown in 30% of these patients who were certified to have died from other causes and the bladder was not mentioned on the death certificate as being a primary cause of death (Table V). It would probably be right to assume that only 10% of these patients had persistent symptomless bladder lesions, but in order to be fair I have assumed that 25% of the persons who died unrelated deaths had lesions in the bladder, and have added these to the related deaths when assessing the numbers of patients who have remained free from the disease for two years or longer.

TABLE V.—ATTEMPT TO ASSESS BLADDER STATE IN THOSE DYING OF OTHER DISEASES

	No.	%
Bladder known to be clear ..	88	59·5
Bladder recurrence	15	10·1
State of bladder unknown ..	45	30·4
Total	148	

Before I had analysed my results I suspected that multiple papillary lesions had a worse prognosis than single papillary lesions, especially when the wall of the bladder was abnormal (injected, cystitis cystica, diverticula, &c). In Table VI the results of treatment of single and multiple papillary tumours are compared and there is no material difference, but it is evident that papillary differentiated tumours, single and multiple, are much more dangerous than papillomata, single or multiple. In Sheffield single lesions have generally been treated by cystoscopic diathermy or by local excision and a radon seed implant. Multiple lesions that could not be controlled by cystoscopic diathermy have been treated by high voltage irradiation from an external source (S.X.R.). I have been in doubt about this and have felt that primary cystectomy might have a place in the treatment of these multiple superficial lesions, but these figures disprove this. The results of treatment of multiple papillary lesions, largely by high voltage irradiation, are as good as the results of treatment of single papillary lesions by other methods and I now feel that we are justified in continuing to treat such cases by high voltage therapy, reserving cystectomy for failed irradiation cases.

TABLE VI.—PROGNOSIS RELATED TO NUMBER OF TUMOURS AND CONDITION OF BLADDER WALL (CLINICAL ASSESSMENT)

	Alive	Dead		Unknown	Total	Percentage free for two years or longer
		Related	Unrelated			
Single: Papilloma						
Wall normal	79	2	23	4	108	93
Wall abnormal	33	—	11	—	44	
Single: Papillary differentiated						
Wall normal	14	10	6	1	31	65
Wall abnormal	31	16	6	—	53	
Multiple: Papilloma						
Wall normal	48	2	11	2	63	90
Wall abnormal	39	5	7	—	51	
Multiple: Papillary differentiated						
Wall normal	14	5	1	1	21	71
Wall abnormal	36	17	23	2	78	

TABLE VII.—THE RESULTS OF INITIAL TREATMENT RELATED TO STAGE

	Histological					*Clinical*					
		Dead					Dead				Survived or bladder clear at death
	Alive	Related	Unrelated	Unknown	Total	Alive	Related	Unrelated	Unknown	Total	
I. *Cystoscopic diathermy*											%
Stage I	82	4	27	—	113	176	6	46	6	234	92
II	3	1	—	—	4	7	2	4	—	13	—
III	2	3	1	—	6	1	4	—	—	5	—
IV	—	1	—	—	1	—	2	1	—	3	—
	87	9	28	—	124	184	14	51	6	255	
II. *S.X.R., &c.*											
Stage I	13	8	3	1	25	11	9	6	1	27	60
II	8	9	4	—	21	21	43	15	—	79	41
III	7	23	6	—	36	12	47	12	—	71	30
IV	—	22	—	1	23	1	35	6	—	42	13
	28	62	13	2	105	45	134	39	1	219	
III. *Excision and radon*											
Stage I	43	8	11	—	62	44	4	13	—	61	88
II	27	8	11	2	48	40	16	14	—	70	72
III	5	7	1	—	13	2	6	—	—	8	—
IV	—	—	—	—	—	—	—	—	—	—	—
	75	23	23	2	123	86	26	27	—	139	
IV. *Combined interstitial radon and S.X.R.*											
Stage I	4	—	4	1	9	4	—	1	—	5	100
II	6	6	1	—	13	7	12	4	2	25	44
III	2	7	2	—	11	1	2	2	—	5	50
IV	—	2	1	—	3	1	1	1	—	3	—
	12	15	8	1	36	13	15	8	2	38	
V. *Cystectomy and ureterocolic anastomosis*											
Stage I	—	1	—	—	1	—	1	—	—	1	—
II	1	1	2	—	4	1	4	2	—	7	—
III	—	6	—	—	6	—	4	—	—	4	—
IV	—	3	—	—	3	—	2	—	—	2	—
	1	11	2	—	14	1	11	2	—	14	

TABLE VIII.—THE RESULTS OF INITIAL TREATMENT RELATED TO GRADE

Treatment	Type of growth	No.	%	Additional treatment given	Survived or bladder clear at death	
				%	%	%
I. Cystoscopic diathermy	Papilloma	216	85	13	93	90
	Papillary differentiated	29	11		70	
	Solid	10	4		0	
II. S.X.R., &c.	Papilloma	17	8	23	63	34
	Papillary differentiated	46	21		50	
	Solid	156	71		26	
III. Excision and radon	Papilloma	26	19	25	85	77
	Papillary differentiated	79	57		84	
	Solid	34	24		54	
IV. Excision and radon and S.X.R.	Papilloma	2	5	45	100	55
	Papillary differentiated	15	40		65	
	Solid	21	55		42	
V. Cystectomy	Papilloma	1				14
	Papillary differentiated	3				
	Solid	10				

If S.X.R. (II) and excision and radon and S.X.R. (IV) are taken together the survival is 37%.

Treatment, initial or additional, was grouped into five methods to determine results, and these have been related to stage and grade and are given in Tables VII, VIII, IX and X. Survivors are alive two to twelve years after treatment, and 75% of the unrelated deaths are added to these to arrive at the percentage of patients who remained free from the disease for two years to twelve years after treatment.

Before I accepted the clinical assessment of papilloma, papillary differentiated, and solid tumours, each tumour was graded by the four methods detailed in Table XI, and the response of these grades to the different methods of treatment was determined.

TABLE IX.—THE RESULTS OF ADDITIONAL TREATMENT RELATED TO STAGE

	Histological					*Clinical*				
		Dead					Dead			
	Alive	Related	Un-related	Un-known	Total	Alive	Related	Un-related	Un-known	Total
I. Cystoscopic diathermy										
Stage I	13	1	2	—	16	14	2	1	—	17
II	3	1	—	—	4	4	2	2	—	8
III	—	1	—	—	1	1	1	1	—	3
IV	—	—	—	—	—	—	—	—	—	—
	16	3	2	—	21	19	5	4	—	28
II. S.X.R.										
Stage I	5	6	2	—	13	6	5	1	—	12
II	2	3	—	—	5	6	6	1	—	13
III	2	6	—	—	8	1	8	—	—	9
IV	—	2	1	—	3	—	3	2	—	5
	9	17	3	—	29	13	22	4	—	39
III. Excision and radon and diathermy and radon										
Stage I	8	—	3	—	11	9	—	3	—	12
II	6	1	—	1	8	8	2	—	1	11
III	2	1	—	—	3	—	1	—	—	1
IV	—	1	—	—	1	—	—	—	—	—
	16	3	3	1	23	17	3	3	1	24
IV. Interstitial radon and S.X.R.										
Stage I	2	1	1	—	4	2	1	1	—	4
II	1	—	1	—	2	2	—	1	—	3
III	1	1	—	—	2	1	1	—	—	2
IV	—	—	—	—	—	—	—	—	—	—
	4	2	2	—	8	5	2	2	—	9
V. Cystectomy and ureterocolic anastomosis										
Stage I	2	—	1	—	3	1	—	1	—	2
II	2	4	1	—	7	3	7	1	—	11
III	2	6	2	1	11	2	8	2	1	13
IV	—	5	—	—	5	—	1	—	—	1
	6	15	4	1	26	6	16	4	1	27

TABLE X.—THE RESULTS OF ADDITIONAL TREATMENT RELATED TO GRADE

Treatment	Type of growth	No.	Survival rate %
I. Cystoscopic diathermy	Papilloma	8	79
	Papillary differentiated	16	
	Solid	4	
II. S.X.R.	Papilloma	8	41
	Papillary differentiated	15	
	Solid	16	
III. Excision and radon	Papilloma	8	79
	Papillary differentiated	9	
	Solid	7	
IV. Excision and radon and S.X.R.	Papilloma	2	75
	Papillary differentiated	2	
	Solid	5	
V. Cystectomy	Papilloma	3	33
	Papillary differentiated	7	
	Solid	17	

In Tables XII and XIII more details are given about the period of survival and cause of death after each treatment, and the information is related to stage. Most of the related deaths occur within three years, and there are few related deaths after survival for five years.

In conclusion I believe that I have produced evidence to support my belief that high voltage irradiation offers something to patients who cannot be treated with any hope of success by other methods. The majority of patients treated by the Sheffield Centre have been in Stage III and Stage IV, and 70% were solid tumours, yet more than a third of them survived two years or longer, or died unrelated deaths, with clear bladders. When primary treatment has failed, secondary treatment may either cure or give relief, and if irradiation has been carefully administered it can in some measure be repeated. Another interesting finding is that secondary cystectomy after irradiation gives very much better results than primary cystectomy. One-third of the patients submitted to this procedure survived two years or longer, although half had Stage III or Stage IV growths. I am learning to admit failure earlier and proceed to secondary cystectomy before the disease is too far advanced.

TABLE XI.—ONE OF MANY TABLES RELATING TREATMENT TO GRADE

	Specimen					*Fragment*				
		Dead					Dead			
	Alive	Related	Un-related	Un-known	Total	Alive	Related	Un-related	Un-known	Total
II. S.X.R., &c.										
Papillomata	7	—	2	—	9	7	3	4	—	14
Papillary differentiated	4	5	1	2	12	3	7	2	1	13
Papillary anaplastic	2	7	—	—	9	1	2	—	—	3
Solid differentiated	—	—	—	—	—	—	—	—	—	—
Solid anaplastic	2	19	2	1	24	1	7	1	—	9
Papillary and solid	1	4	2	—	7	2	4	—	—	6
Squamous carcinoma	3	13	1	—	17	2	9	2	—	13
Adenocarcinoma	1	1	—	—	2	—	1	—	—	1
Indefinite	—	—	1	—	1	—	3	2	—	5
No histology	25	85	28	—	138	29	98	26	2	155
	45	134	37	3	219	45	134	37	3	219

	Cytology					*Clinical*				
		Dead					Dead			
	Alive	Related	Un-related	Un-known	Total	Alive	Related	Un-related	Un-known	Total
Papillomata	5	2	—	—	7	7	5	5	—	17
Papillary differentiated	6	9	2	1	18	16	20	8	2	46
Papillary anaplastic	—	2	—	—	2	1	5	—	—	6
Solid anaplastic	2	6	4	—	12	15	66	13	1	95
Papillary and solid	—	1	—	—	1	6	38	11	—	55
Squamous carcinoma	1	3	—	—	4	—	—	—	—	—
Indefinite	6	13	4	—	23	—	—	—	—	—
No histology	25	98	27	2	152	—	—	—	—	—
	45	134	37	3	219	45	134	37	3	219

TABLE XII.—SURVIVAL PERIODS AFTER INITIAL TREATMENT RELATED TO STAGE

	Dead		Alive between 2 and 3 years	Alive 3 years	Dead		Alive between 3 and 5 years	Alive 5 years	Dead		Alive between 5 and 10 years	Alive 10 years	Totals: Dead within 12 years		Totals: Alive 2–12 years	Total cases
	Related	Un-related			Related	Un-related			Related	Un-related			Related	Un-related		
								Cystoscopic Diathermy								
Stage I	3	13	32	186	5	20	46	131	6	42	82	26	6	46	182	234
II	2	2	1	8	2	2	2	6	2	3	1	4	2	4	7	13
III	3	—	—	2	4	—	—	1	4	—	1	—	4	—	1	5
IV	2	1	—	—	2	1	—	—	2	1	—	—	2	1	—	3
								S.X.R.								
Stage I	5	2	2	18	7	5	3	10	8	6	4	4	9	6	12	27
II	37	10	2	30	41	11	5	20	43	15	11	3	43	15	21	79
III	47	10	2	12	47	11	4	7	47	11	6	1	47	12	12	71
IV	35	6	—	1	35	6	—	1	35	6	1	—	35	6	1	42
								Excision and Radon								
Stage I	1	9	6	45	3	11	17	24	4	13	21	—	4	13	44	61
II	9	10	12	39	14	10	11	23	16	14	14	3	16	14	40	70
III	6	—	1	1	6	—	1	—	6	—	—	—	6	—	2	8
IV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
								Combined Interstitial Radon and S.X.R.								
Stage I	—	—	1	4	—	—	—	4	—	1	3	—	—	1	4	5
II	9	3	3	10	12	4	2	4	12	4	3	1	12	4	9	25
III	2	1	1	1	2	2	—	—	2	2	—	—	2	2	1	5
IV	1	1	—	1	1	1	—	1	1	1	1	—	1	1	1	3
								Cystectomy and Ureterocolic Anastomosis								
Stage I	—	—	—	1	—	—	—	1	1	—	—	—	1	—	—	1
II	3	2	—	2	4	2	—	1	4	2	—	1	4	2	1	7
III	4	—	—	—	4	—	—	—	4	—	—	—	4	—	—	4
IV	3	—	—	—	3	—	—	—	3	—	—	—	3	—	—	3

All cases treated primarily by (I) Cystoscopic diathermy (259), (II) Interstitial irradiation with or without excision of the growth (140), and (III) High voltage irradiation with or without surgery or interstitial irradiation (263) were handed to a statistician with the numbers (*a*) dead of cancer, (*b*) dead of intercurrent disease, (*c*) alive and well, (*d*) alive with cancer. He found that in Groups (I) and (II) there were insufficient deaths to provide enough data to fit a smooth curve, and for these he advised a longer-term investigation. He found that Haybittle's (1959) method worked well for Group III and concluded that the percentage of cases permanently cured by high voltage

TABLE XIII.—SURVIVAL PERIODS AFTER ADDITIONAL TREATMENT RELATED TO STAGE

	Dead		Alive between 2 and 3 years	Alive 3 years	Dead		Alive between 3 and 5 years	Alive 5 years	Dead		Alive between 5 and 10 years	Alive 10 years	Totals: Dead within 12 years		Alive 2–12 years	Total cases
	Related	Un-related			Related	Un-related			Related	Un-related			Related	Un-related		
								Cytoscopic Diathermy								
Stage I	—	1	1	15	1	1	7	7	2	1	4	2	2	1	14	17
II	—	1	—	7	2	1	2	3	2	2	1	1	2	2	4	8
III	1	1	—	1	1	1	1	—	1	1	—	—	1	1	1	3
IV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
								S.X.R.								
Stage I	2	1	1	8	4	1	1	5	5	1	3	1	5	1	6	12
II	3	1	4	5	5	1	—	3	6	1	1	1	6	1	6	13
III	7	—	1	1	8	—	—	—	8	—	—	—	8	—	1	9
IV	3	2	—	—	3	2	—	—	3	2	—	—	3	2	—	5
								Excision and Radon								
Stage I	—	1	1	10	—	2	3	6	—	3	4	1	—	3	9	12
II	2	—	3	6	2	—	4	2	2	—	1	1	2	—	9	11
III	1	—	—	—	1	—	—	—	1	—	—	—	1	—	—	1
IV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
								Interstitial Radon and S.X.R.								
Stage I	—	—	—	4	—	1	—	3	—	1	3	—	—	1	3	4
II	—	1	—	2	—	1	1	1	—	1	1	—	—	1	2	3
III	1	—	—	1	1	—	—	1	1	—	1	—	1	—	1	2
IV	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
								Secondary Cystectomy with Ureterocolic and Ileal Diversion								
Stage I	—	—	—	4	—	—	—	4	2	1	1	—	2	1	1	4
II	8	1	—	10	11	1	1	6	14	1	3	—	14	1	1	19
III	7	1	2	6	8	4	1	1	8	4	1	—	8	4	4	16
IV	1	—	—	—	1	—	—	—	1	—	—	—	1	—	—	1

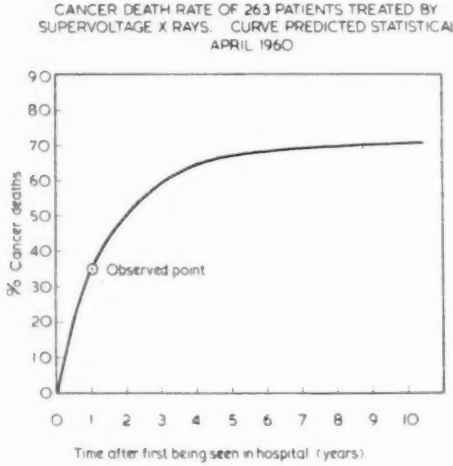

FIG. 1.

irradiation was 29·5% with a standard error of 3·5%. Fig. 1 shows the predicted cancer death-rate. These figures are not far removed from those arrived at by me by cruder methods.

As the results of high voltage irradiation are studied it should be noted that 30% were in Stage III and 20% in Stage IV and these were possibly inoperable; also 7% were multiple papillomata, 23% multiple papillary differentiated, and 70% solid tumours.

Acknowledgments.—I am indebted to Mr. Walter Scott of Doncaster for sending me 100 of these patients, and pay tribute to his excellent clinical assessment. I also wish to thank all who have assisted me in treating these patients: Mr. J. F. V. Larway who made the slides; Mr. M. C. W. Catlin, the Finance Officer to the United Sheffield Hospitals and especially Mr. George Blomfield who has been responsible for the radiotherapeutic treatment. Lastly I wish to thank the Board of Governors for secretarial help and the use of the Powers-Samas machine in the Finance Department

REFERENCE

HAYBITTLE, J. L. (1959) *Brit. J. Radiol.*, **32**, 725.

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MJ2

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Meeting
March 25, 1960

THE VACUUM EXTRACTOR (VENTOUSE)—AN ALTERNATIVE TO THE OBSTETRIC FORCEPS

Professor J. Snoeck (Brussels, Belgium):

Theory and Principles

The vacuum extractor consists of a flattened round metal cup with bulging sides so that the diameter of the mouth is somewhat smaller than the maximum external diameter. The form is such that, when suction is applied, an artificial caput succedaneum is created, occupying the free space within the cup. This caput has a button-like form (the "chignon" as we say in French) on which strong traction may be applied without risk of detachment.

In 1957 Malmström published a monograph in which he justified on mathematical grounds the form of his vacuum extractor.

It is possible to show on mechanical grounds that the vacuum extractor is less dangerous than the forceps when used under given clinical conditions. This was first demonstrated by Rosa (1955).

Let us suppose that a cup measuring 55·5 mm diameter has been correctly applied to the occiput of a fœtal head at term. The area covered by the cup is a circle of 2·75 cm radius, 17 cm circumference and with an area of 24 sq. cm. The internal surface of the dome against which the skin of the fœtal head will be aspirated may be represented by a round button, 2 cm thick at its centre, 3 cm in radius and with an area of 38 sq. cm.

If we now aspirate until a "half-vacuum" exists within the cup, that is a sub-atmospheric pressure of half an atmosphere, each square centimetre of skin inside the cup will be under a pressure of 500 grams, which can be called the adhesive force.

If, now the cup is in place, we exercise a pull of 10 kg perpendicular to the plane of its mouth, this traction is distributed to the rim of the cup and is of the order of 590 g/cm. This tractional force consists of two components, one acting on the skin of the head (tc) and the other perpendicular to the internal surface of the cup tending to detach it from the cranial vault (td). Without entering into details of the calculations which allow one to establish the value of the latter component, for the experimental conditions of which we are speaking, its value (td) of about 340 g is less than the adhesive force of some 500 g, therefore the dome remains attached. The fœtal skin at the cup edge experiences a stretching force tc of about 480 g/cm and, in accordance with the laws of elasticity, this stretching will only end when an equal and opposite force (r) acts on the stretched skin. When these conditions prevail the system is a state of elastic equilibrium.

It is also apparent from these calculations that although the tractional force is 480 g/cm at the edge of the cup, due to the distortion of cranial skin into a truncated cone-like shape, this force is reduced to 310 g at the level of skin attachment to the cranium, i.e. at the base of the cone where the circumference is 26 cm. Here, the cranial skin closely invests the bony cranium and may be considered as having a spherical shape. If one imagines a quadrilateral piece of skin in the region of skin attachment to the cranium, each of its sides will be subjected to an elastic tension created by the traction. These forces result in a component tending to compress the fœtal skull which responds by an equal and opposite outwardly directed pressure.

By using the formula $2t/r = \pi$, we may calculate the intracranial pressure when a traction of 10 kg is applied. It is of the order of 75 g/sq. cm.

If the traction exerted on the cup ceases to be vertical and becomes oblique, the line of pull no longer passes through the symmetrical axis of the cup and a couple is created tending to detach the cup, one side of its rim pivoting against the cranium and the opposite side tending to detach from it. This inequality of forces along the rim lessens the adhesive force and may even reduce it below the value required for a normal traction thus resulting in untimely detachment.

By way of contrast, let us consider the pressure created inside the fœtal skull by an obstetric forceps applied in the classical manner and on which a traction of 10 kg is exerted. The segment of the blade perpendicular to the cranial diameter (*between the blades*) undergoes a traction (T) which may be resolved into a sliding force (D) directed tangentially to the fœtal skull and a pressure force directed inwards against the skull (P). This latter pressure creates a friction which at a certain moment prevents the slipping of the instrument. The nearer one approaches the tips of the blade, the less does the slipping power (D) become and the more does the pressure (P) rise.

If one exerts an additional pressure by actively closing the blades in a scissor-like fashion, one creates an additional crushing pressure on the fœtal skull adding to that already present from pure traction. Such a force adds to the frictional component and eventually neutralizes the sliding tendency. Along these lines it is possible to show, assuming the maximal coefficient of friction between skin and steel to be 0·4, that the risk of slipping can only be overcome when the ends of the blades exert an intracranial pressure of 1,400–1,500 g/sq. cm. At the level of the body of the blade adherence may be obtained only by severe compression. One can easily understand why the tips of the blades traumatize the soft parts of the new-born as they are the only points of contact in a correct application. Every mark of the blade on the body must be considered as evidence of grossly excessive pressure.

Summing up, the intracranial tension created by the vacuum extractor in the least favourable circumstances (i.e. the smallest cup size) is only *one-twentieth* of that created by the forceps used under the most favourable conditions (i.e. with the curve of the blades exactly fitting the fœtal skull, resulting in a maximum coefficient of friction).

Techniques and Clinical Applications of the Vacuum Extractor

Anæsthesia.—A local perineal infiltration of 0·5% lignocaine is more than adequate.

When the cup is fitted to the head during contractions, no general anæsthetic is necessary or desirable because one of the principal advantages of the vacuum extractor is that it enables traction by the operator to be co-ordinated with the spontaneous uterine contractions. These may be modified if necessary by an intravenous oxytocin drip.

Introduction and application of the cup.—The cup is introduced by placing it edgeways in the vagina and pressing back strongly against the perineum. Under the control of two fingers the cup is pushed towards the head and placed in direct contact with it at its most inferior and/or posterior parts. One must avoid placing the dome too anteriorly as this, though without serious consequences, does involve an increased risk of detachment due to obliquely directed traction, especially in high applications in primigravidæ.

The dome is held in place manually at the chosen site while an assistant creates a vacuum of the order of two-tenths of an atmosphere. At the same time, and taking advantage of the few minutes required for the formation of the artificial caput succedaneum within the cup, the operator carefully verifies, with a forefinger moved round the edge of the cup, that it is directly applied to the head without the inclusion of maternal tissue such as portions of the vaginal wall and, especially in multiparæ, portions of the cervix. Inclusion of the cervix may occur not only in grand multiparæ but also in primigravidæ if the small cup is applied before complete dilatation of the cervix. When such nipping occurs it is sufficient to slide the finger in a circular movement around the edge of the cup to recognise and at the same time to free the inclusion before the vacuum is increased.

After two or three minutes the vacuum is increased to four-tenths of an atmosphere and after a further pause of the same interval, six-tenths of an atmosphere may be applied and eventually, if necessary, eight-tenths.

It is important not to begin traction without pausing for the above time intervals. The quality of the "chignon" or artificial caput which is the most important factor in good adhesion depends essentially on the time allowed for its formation.

Traction should be intermittent and designed to coincide with the spontaneous uterine contractions. If traction is performed with the right hand the index and middle finger of the left hand verify the progress of fœtal movement and exercise light pressure in a posterior direction, especially if the cup has been placed too anteriorly. This pressure corrects to a certain extent the effect of traction not directed strictly along the pelvic axis. The left hand also verifies to what extent spontaneous rotation of the head is taking place—such rotation occurring frequently. When the cup is applied centrally to the presenting part and not allowed to infringe on the space surrounding it, it allows by a combination of uterine pressure and manual traction such natural movements as rotation or asynclitism. It is rarely necessary to use the vacuum extractor for correcting occipito-posterior positions by active rotation. If such a manœuvre must be attempted, it is sufficient to twist the traction in the required direction whereupon the head almost invariably follows without further difficulty. It is also possible to facilitate active rotation by exerting a gentle counterpressure with the finger of the left hand.

Stimulation of uterine contractions.—Malmström seems to have shown by means of external tocometry that the tractional force applied to the vacuum extractor during the passage of the head through an incompletely dilated cervix causes stimulation in the region of the internal os which increases the activity of uterine contractions. For our own part, we have effectively used the vacuum extractor in several cases of uterine hypotonia with a cervical dilatation of 4 to 6 cm. We observed that thanks to the

synchronization of traction with the spontaneous uterine contractions, an improvement in physiological activity of the uterus, due presumably to the above cervical mechanism, occurred with little delay. However, such indications are exceptional and we must accept such evidence with due caution.

The indications for Malmström's cup include all the indications for forceps excluding face presentations. The use of the instrument is not indicated in breech presentations.

Results

During the period 1954–1959 a total of 7,886 infants were born at the university clinic. In this series, the vacuum extractor was used 410 times (Table I). In 1954 we cautiously tried our first experiments, and from the beginning of 1955, as Table I shows, the frequency with which

TABLE I.—USE OF THE VACUUM EXTRACTOR

	1954	1955	1956	1957	1958	1959	Total
No. of deliveries	1,058	1,228	1,355	1,368	1,362	1,416	7,787
No. of infants born	1,079	1,246	1,365	1,380	1,385	1,431	7,886
No. of forceps deliveries	20	9	2	3	3	0	37
No. of deliveries using the vacuum extractor	6	44	78	81	92	109	410

the vacuum extractor was used rose steadily, indicating our growing confidence in the instrument.

Table II shows that from 1954–1959, the total

TABLE II.—INSTRUMENTAL DELIVERIES

	1954	1955	1956	1957	1958	1959
Total instrumental deliveries	26	53	80	84	95	109
%	2·45	4·31	5·90	6·14	6·97	7·69
Forceps deliveries	20	9	2	3	3	0
%	1·89	0·73	0·14	0·21	0·22	0
Deliveries using the vacuum extractor	6	44	78	81	92	109
%	0·56	3·58	5·75	5·92	6·75	7·69

number of instrumental deliveries rose from 2·45% to 7·69%. The incidence of forceps deliveries fell to zero while that of vacuum extractor deliveries rose steadily.

Table III summarizes the principal indications

TABLE III.—INDICATIONS FOR USE OF VACUUM EXTRACTOR

	1954	1955	1956	1957	1958	1959
Prevention of maternal disorders	2	13	20	19	19	16
%	33·3	29·5	25·6	23·4	20·6	14·6
Pelvic deformity	2	7	10	12	16	23
%	33·3	15·9	12·8	14·8	17·3	21·1
Fœtal distress	—	7	17	20	15	18
%	—	15·9	21·7	25·9	18·4	16·5
Mechanical difficulty	2	17	26	26	28	48
%	33·3	38·6	33·3	32	41·3	44
Clinical demonstration	—	—	5	3	2	4
%	—	—	6·41	3·70	2·17	3·67

for the new instrument. In the group of prophylactic indications and in maternal disorders, we find grouped together indications concerned with gravid pathology (toxæmias) and those concerned with medical conditions complicating pregnancy (pulmonary conditions, cardiac states, poliomyelitis, etc.).

By the term *mechanical difficulty* we understand not only uterine dyskinesia but also cephalopelvic disproportion due to poor flexion of the head or to the arrest of cephalic rotation. In general these troubles are treated according to principles developed in our clinic; for example, by oxytocin perfusion, by the position of hyperflexion in the mother to improve dystocia in the region of the pelvic inlet or by other postural therapeutic means resulting from clinical and radiological studies of the maternal pelvis and fœtal head respectively.

Table IV summarizes the application of the

TABLE IV.—APPLICATION OF VACUUM EXTRACTOR IN RELATION TO PARITY

	1954	1955	1956	1957	1958	1959
Total No. of deliveries with vacuum extractor	6	44	78	81	92	109
Primiparæ	5	38	57	64	67	88
%	83·3	86·3	73	79	72·8	80·7
Multiparæ	1	6	21	17	25	21
%	16·6	13·6	26·9	20·9	27·1	19·2

cups in relation to parity. It confirms the greater frequency of instrumental extraction in primigravidæ.

The fœtal neonatal mortality is the most important factor to analyse as it is the principal criterion in assessing the safety or otherwise of a new method of fœtal extraction. Table V

TABLE V.—FOETAL MORTALITY

	1954	1955	1956	1957	1958	1959
Total deaths (corrected)	24	32	29	21	23	23
Primiparæ: *Deaths after application of vacuum extractor*						
Total deaths (uncorrected)	0	2	0	2	2	2
Birth weight below 2·5 kg (uncorrected)	0	0	0	1	0	0
Birth weight above 2·5 kg (corrected)	0	2	0	0	2	0
Multiparæ:						
Total deaths (uncorrected)	0	0	3	0	2	3
Birth weight below 2·5 kg (uncorrected)	0	0	0	0	1	0
Birth weight above 2·5 (corrected)	0	0	3	0	1	2

summarizes the neonatal mortality after application of the vacuum extractor during the six-year period 1954–1959. During 1954, when six applications of the instrument were performed, no fœtal mortality was recorded. However, this has little statistical significance when compared

with the number of forceps deliveries in the same year.

For the following five years we have included in the perinatal mortality (unselected) all cases of death *in utero* or death during labour regardless of its cause.

Here we have grouped two distinct entities, in one the infants weighing between 1,000 and 2,500 g at birth, and in the other those weighing more than 2,500 g. We have picked out all the cases of stillbirth or neonatal deaths in which the cause of death could not be attributed to the method of extraction used; this concerns essentially cases in which (*a*) the birth weight was less than 1 kg; (*b*) the new-born was macerated; (*c*) fœtuses with congenital malformations incompatible with life. The distinction between the two groups of infants of weight less and more than 2,500 g applies if one desires to compare the results with those obtained by use of the forceps. In our clinic, we never apply the forceps to an infant which we think to be premature as we deem this too dangerous. However, since using the vacuum extractor we have changed our opinion in this sphere and from time to time, to shorten the second stage, we apply the new instrument to such premature infants.

Table V shows that in twelve instances an explanation of the cause of death is necessary. All cases were subjected to post-mortem examination and we are indebted to the pathologists for the findings.

(*a*) Two cases of birth weight below 2,500 g died after the application of the vacuum extractor. Autopsy revealed in one that the child, which was born in asphyxia pallida after twenty minutes' traction, showed a generalized capillary hæmorrhagic tendency in all organs. It was certain that this state was associated with anoxia and had nothing to do with the application of the vacuum extractor.

In the other premature child, born in 1958, autopsy showed an isolated meningeal hæmorrhage of the classical form seen after rupture of the tentorium cerebelli. At first sight this could have been due to the vacuum extractor. In any case the child was very premature; the indication for delivery was pulmonary tuberculosis complicating the mother's diabetes.

(*b*) In children weighing more than 2,500 g the autopsy thrice showed suprarenal hæmorrhage, petechial meningeal hæmorrhages and pulmonary atelectasis. It is evident from the multiplicity of these hæmorrhages that they were the consequences of anoxia.

Four other children presented various lesions: pulmonary atelectasis; neonatal bronchopneumonia, hæmoperitoneum due to rupture of the liver (Glisson's capsule) and, in the fourth child, death on the second day showing at autopsy multiple pulmonary embolism.

The last 3 cases of fœtal death were: (1) A purulent meningitis on the fifth neonatal day after the application of the cup followed by the forceps. Microscopical examination of the cranial skin revealed no local cause and we assume that the case was one of neonatal meningitis.

(2) The third child of a mother aged 26: prolapsus of the umbilical cord with the cervix 3 cm dilated. An immediate Cæsarean section was proposed but the theatre was occupied. A digital dilatation of the cervix was performed with application of the cup and later the forceps. Both measures failed and we extracted the child dead after version. On all evidence the child, which weighed 3,800 g, died due to wrong obstetric manœuvres.

(3) The last death was one in which the application of the vacuum extractor went wrong. It was followed by a double application of the forceps, first the classical and then the Kielland. These operations were difficult and a dead infant was extracted, showing an indisputable traumatic hæmorrhage. In any case we blame here, rightly or wrongly, the vacuum extractor. We must point out, however, that the child died due to an error in the indication for operation. There was no doubt on looking back that a Cæsarean section was the treatment of choice (Resa and Piraux, 1957).

Thus if we analyse these 12 cases, we can only blame two or three deaths on the vacuum extractor. The others did not result from its use but rather from its not being used in time.

Alongside the complete failure causing neonatal deaths we must mention the failures we experienced due to repeated detachment of the vacuum extractor. Sometimes after such incidents it was necessary to apply the forceps, but in any case such occurrences will decrease in frequency as our experience in the use of the extractor grows.

Table VI shows that in 410 applications of the

TABLE VI.—PRESENTATIONS AND FAILURES

	1954	1955	1956	1957	1958	1959	Total
Anterior presentations	3	21	40	40	49	69	222
Failures ..	—	2	1	1	1	1	6
Transverse presentations	1	3	5	11	24	16	60
Failures ..	1	1	—	—	2	—	4
Posterior presentations ..	2	17	31	28	15	20	113
Failures ..	—	3	1	—	1	—	5
Oblique presentations ..	—	3	2	2	2	4	13
Failures ..	—	—	1	—	—	—	1
Breech presentations ..	—	—	—	—	2	—	2
Failures ..	—	—	—	—	—	—	—

TABLE VII.—LEVELS OF APPLICATION

	1954	1955	1956	1957	1958	1959
No. of deliveries with vacuum extractor	6	44	78	81	92	109
Pelvic inlet	4	2	13	8	6	5
%	66·6	4·54	16·6	9·87	6·52	4·58
Pelvic cavity	1	25	30	23	32	32
%	16·6	56·8	38·4	28·3	34·7	29·3
Pelvic outlet	1	17	35	50	54	72
%	16·6	38·6	44·8	61·7	58·6	66

In conclusion, our results are those of five years of practice with the new instrument. They have confirmed the theoretical speculations that it is an instrument with a wide margin of safety. This fact coupled with its simple design, requiring no general anæsthesia and permitting the active co-operation of the mother, is a strong point in its favour. It is surely significant that during the *fifth year of its use, we have never once had to resort to the obstetric forceps* and during this year, our general perinatal mortality was very low.

TABLE VIII

	General fœtal mortality rate %					Fœtal mortality rate after use of vacuum extractor %
	1955	1956	1957	1958	1959	1954–1959
Total fœtal mortality rate	4·17	3·44	2·39	3·03	3·42	3·90
Corrected fœtal mortality rate	2·61	2·14	1·52	1·66	1·60	2·92

vacuum extractor we had only 16 detachments: 6 detachments in 222 anterior presentations; 4 detachments in 60 cases of transverse lie and 5 in 113 posterior presentations. These partial failures are due to the fact that we did not give sufficient attention to the rules of application, i.e. to wait for 6 to 8 minutes before commencing traction so as to allow good formation of the artificial caput. In fact three-quarters of our failures occurred during the four first years of practice.

Table VII concerns the use of the vacuum extractor at various levels of application. This shows that high applications become progressively more and more rare, and that in most cases the instrument is used in the lower pelvic regions.

Table VIII shows the general perinatal fœtal mortality rate in our clinic from 1955 to 1959. It also shows the fœtal perinatal mortality rate calculated on the total number of infants delivered by the vacuum extractor during the same period to be 3·9%. If we subtract from the total the cases of stillbirth, macerated fœtus, congenital abnormalities incompatible with life and those of birth-weight less than 1 kg, the perinatal mortality rate in the series of infants removed by the vacuum extractor is 2·92%. In any case, the number of children born dead by its use is small in comparison to the large number of times it was used. It should also be noted that in four of the deaths the indication for the use of the new instrument was *grave fœtal distress*, which is my opinion the only disputable indication; in three cases the indication was arrest of the progress of labour, and in 2 cases there is no doubt in retrospect that we should have performed Cæsarean section instead of trying to effect delivery *per vaginam*.

Twice the vacuum extractor was used in a bleeding lateral placenta prævia, and lastly, it was used three times for medical indications.

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Mr. J. A. Chalmers (Worcester):

Professor Snoeck first introduced me to the ventouse in Brussels three years ago. I learned later that one of the earliest instruments of this type was described by Sir James Young Simpson in 1849 (Fig. 1).

I cannot follow Professor Snoeck entirely in advocating complete replacement of the forceps with the ventouse but even with certain limitations we have found it most valuable, enabling us to deal with some of our problems in a manner which we could have employed with no other instrument. Since May 1958 we have used the Malmström instrument, as modified in

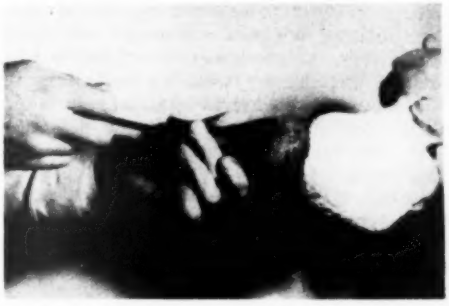

FIG. 1.—The Simpson vacuum extractor. (Photograph by courtesy of Professor R. J. Kellar.)

1957, in 127 labours with 132 deliveries. Details of our first 100 cases have been published (Chalmers and Fothergill, 1960) and we have discussed the limitations of the method which we have found: (1) Where acute fœtal distress has made delivery a matter of some urgency and forceps have been preferred as being somewhat quicker (cf. de Watteville, 1958; Voegli, 1958). (2) Where there is material cephalo-pelvic disproportion which only powerful traction can overcome. In such cases detachment of the ventouse will occur. (Goldberg and Levy, 1958, regard this as a safety factor, carrying no risk to the fœtus, in contrast to that of detachment of the forceps.)

In both the above we have retained the use of the forceps. We have also used forceps where delivery could have been effected with as much or greater ease and safety with the ventouse, in order to train our house surgeons in the use of the more orthodox instrument. They are still more likely to use the forceps in general practice, at least until the ventouse is more widely accepted in this country. None the less, all our house surgeons, most of whom have little or no experience of operative obstetrics, have readily learned the use of the ventouse.

Overall Results

In the hands of various operators, we have employed the method in the delivery of 132 fœtuses. In 116 of these delivery was completed with the ventouse alone. In 6 of the remaining cases fœtal distress led to abandonment of the ventouse. In 9 cases cephalopelvic disproportion required powerful traction leading to displacement of the ventouse and delivery was completed with forceps. In 7 of these the ventouse was regarded as useful in securing dilatation of the cervix and descent and rotation of the head was secured before application of the forceps. Malmström (1954) advocated the use of the ventouse in this way to facilitate subsequent forceps delivery. In only one case did we consider that the ventouse contributed nothing to the delivery. This was eventually completed by rotation and delivery with Kielland's forceps. The last case was delivered by Cæsarean section, a trial application of the ventouse (cf. Jeffcoate, 1953: trial forceps) having shown marked disproportion.

As was to be expected, when the tractor does not impinge upon the birth canal, trauma to the mothers was minimal. Episiotomy was used in a large proportion of cases, and in one case of delivery face to pubis a very wide episiotomy encroached upon the rectal sphincter but in this and in all other cases primary healing without sequelæ occurred.

In the children, the "chignon" abated rapidly in all instances. Minor abrasions were present in a few cases, but these healed within three to four days. Two cephalhæmatomata occurred but these also largely subsided within a week. There were 3 stillbirths, 2 in cases where intra-uterine death from placental failure had occurred some hours before delivery; the third was a second twin weighing 1 lb 13 oz extracted from an inert uterus after spontaneous premature labour at thirty weeks. There were 2 neonatal deaths in one of which delivery had been completed with forceps after detachment of the ventouse; the other occurred in a premature child weighing 4 lb 8 oz. All other children left hospital in good condition and none showed any evidence of intracranial injury.

We have found the ventouse especially valuable in two groups of cases: incomplete dilatation of the cervix and malposition of the vertex with malpresentation. These groups may overlap each other and both these problems may present in one case.

Incomplete Dilatation of Cervix

There is considerable disagreement as to the place for intervention in the first stage of labour. Cunningham (1958) considers that the cervix must be fully dilated before application but Malmström (1957), Berggren (1958), Chang (1958) and many others describe successful employment of the method before this has occurred. Bruniquel and Israel (1958) suggest that dilatation should be 5 cm or more before application.

I should be the last to advocate a return to accouchement forcé, but we are all familiar with the case where labour is arrested towards the end of the first stage, with the cervix three-quarters dilated, the mother becoming increasingly exhausted and signs of fœtal distress further blackening the horizon. Conservative management with morphine, intravenous dextrose, caudal analgesia, &c., will solve the problem in some cases, but in many increasing distress will demand operative interference. Dührssen's incisions and manual dilatation and forceps delivery usually require general anæsthesia and ventouse extraction can provide a simpler and less traumatic solution to the problem, safer for mother and fœtus, requiring only regional anæsthesia. Further, it has the psychological advantage of permitting the active co-operation of the mother in her own delivery, and the physiological one of augmenting the natural forces promoting dilatation of the cervix, rather than the artificial approach of the alternatives. We have successfully delivered a multipara with fœtal distress due to extensive placental infarction

whose cervix was considerably less than half-dilated at the beginning of the operation (which was completed in forty-five minutes). We believe, however, that such a case is usually better dealt with by Cæsarean section, and that only where the cervix is three-quarters or more dilated should the ventouse be employed. In such a case, traction synchronous with uterine contractions will generally lead to completion of dilatation with gratifying ease, and often only one or two pains are required to effect delivery; we have been favourably impressed with the absence of trauma to the cervix. It is too early to say yet whether or not subsequent prolapse is likely to be a problem, but certainly so far there is no evidence of any need for anxiety on this score.

The cervix was incompletely dilated in 26 of our cases. In 15 of these the indication for intervention was maternal distress with prolongation of the first stage and inertia. In 10 cases fœtal distress was the indication, the cord being prolapsed in one of these. In the last case intervention was undertaken because of lack of progress in the presence of the uterine scar of an extensive myomectomy. 20 patients were primiparæ and 6 multiparæ. In 18 cases the intervention was completely successful. In the remaining 8 cases forceps were used to complete the delivery but in only one of these did we consider that ventouse extraction was of no assistance. In the remainder, completion of dilatation of the cervix was achieved prior to forceps application, but powerful traction required afterwards led to detachment of the instrument.

Malposition and Malpresentation

Here too there is no unanimity of opinion regarding the place of the ventouse in management. Meinrenken and Scheiferstein (1957) state that the method is valueless where the head is deflexed or in malpresentation. Charrier and Docquier (1957), Pigeaud (1957) and Cunningham (1958) all regard incomplete rotation before application of the ventouse as a cause of failure. Rossboth (1959) considers that the ventouse should be applied to the normally rotated skull and Rossel and Champod (1958) are afraid to use it in posterior positions because of the risk of suction on the anterior fontanelle. On the other hand, Bruniquel and Israel (1958) and Muller (1959) both refer to the descent of the head upon traction being accompanied by rotation under absolutely physiological conditions, and in complete freedom, where forceps may impose an abnormal rotation and also deflexion. Rosa (1955) refers to the advantages of the ventouse where incomplete flexion, asynclitism or failure of rotation interfere with the normal mechanism and Evelbauer (1956) has used the happy term "autorotation" for the movement which may follow its application. Rossel and Champod (1958) and Bruniquel and Israel (1958) also point out that when the head is at the vulva, it can be oriented as desired. Voegli (1958) described 44 cases in which rotation took place, and 10 delivered face to pubis. In our own series, there were 73 cases in which the occiput was anterior. Of the remainder, the vertex presented in 53, the occiput being posterior in 23, and lateral in 30. Of the former, autorotation to the front occurred in 9 and 8 more cases were delivered with the ventouse face to pubis. In 3 cases forceps were applied and the head delivered face to pubis, and in 2 after rotation with the ventouse forceps delivery with the occiput anterior was achieved. The last case was that referred to above where the "trial ventouse" was followed by Cæsarean section.

In 30 cases of transverse arrest rotation to the front occurred in 27. In the remainder Kielland's forceps rotation and extraction was carried out in 2. The third was delivered with the occiput transverse. It is of interest to note that a similar result occurred in 6 out of 54 cases of transverse position delivered spontaneously in Williams' series (1953).

In 3 cases the breech presented but progress was arrested with the breech still high in the pelvis and manual extraction would have presented much difficulty. Despite the opinion of Eschbach and Gandar (1957) that it can be used successfully only with a cephalic presentation, application of the ventouse to the anterior buttock as advocated by Kaser (1958) made relatively rapid and easy delivery possible. It was necessary in one case to bring down a leg once the groin was brought within reach. No difficulty was experienced with "suction of the pelvic orifice" or with hæmatoma formation as feared by Rossel and Champod (1958).

Brow presentation occurred in 3 cases. Rossel and Champod (1958) and Muller (1959) observe that flexion of the head can be achieved as required by means of the ventouse, and in 2 of our cases reapplication of the cup two to three times farther and farther back led to flexion of the head and ultimate delivery as a vertex in each instance. In the third, a somewhat inexperienced house surgeon delivered a small child through a large pelvis with the cup firmly attached to the brow. The fact that this child showed no ill effects is perhaps more a tribute to the safety of the method than anything else. Had there been serious disproportion necessitating too powerful traction, detachment of the cup would have occurred.

Conclusion

Our experience of the ventouse leads us to believe with Sohie (1957) that the ventouse is an efficient and harmless instrument with many advantages over forceps. Its successful use depends upon correct application (Bourg,1957; Blackman *et al.*, 1956). Detachment is usually due to too rapid induction of the vacuum (Dexeus, 1957), to oblique traction (Rosa, 1955) or to the interposition of a fold of vaginal wall or a flap of cervix between the cup and the scalp (Malmström, 1957; Bruniquel and Israel, 1958). For this last reason, cervical incisions should be avoided (Malmström, 1957; Evelbauer, 1956). Induction of a vacuum of 0·8 kg/sq. cm requires six to eight minutes to secure proper adhesion (Wespi, 1958) and more powerful traction requires the larger cups. Where very powerful traction is required, detachment is inevitable and either forceps application or Cæsarean section will be required. The ventouse allows prolonged moderate traction, the forceps shorter stronger traction. In most cases the relative slowness of the ventouse is largely compensated by the diminution of trauma (Muller, 1959) but in acute fœtal distress forceps delivery may be preferable. In premature infants, the reduced compression of the fœtal head with ventouse extraction as compared with forceps is a considerable advantage (Rosa, 1955). Its application in the first stage and in malposition and malpresentation makes it especially valuable. Although the ventouse cannot replace the forceps in all its applications, it provides some new indications which are not possible with the forceps.

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Mr. G. T. Smedley (London):

Since July 1958 a series of 66 cases has been studied where the vertex presented and there was an indication to assist or accelerate vaginal delivery (Table I). In the first year of this investigation the vacuum extractor was used instead of forceps where the cervix was fully dilated, but later the indications were extended to include cases of inertia in the first stage of labour.

The majority of patients were given a perineal infiltration or pudendal nerve block using 0·5% lignocaine (60 ml) prior to applying the extractor cup. A proportion of patients also received an intravenous sedative "cocktail" consisting of chlorpromazine 12·5 mg and pethidine 50 mg in 10 ml of normal saline.

A vaginal examination was then made to check the degree of cervical dilatation and the position and station of the fœtal head. An attempt was made to stretch the cervix digitally where necessary. The largest diameter cup which could be introduced was then applied to the lowest aspect of the presenting part with the direction knob pointing towards the occiput. A vacuum up to 0·85 kg/sq. cm was gradually induced over ten to fifteen minutes before traction commenced.

The series has been assessed in two groups to show the improvement in results gained by minor variations in technique and experience, the chief improvement being the more rapid attainment of a greater vacuum in the later cases of the series.

Table I.—Indications for Vacuum Extraction

Delay in second stage	28
Fœtal distress	9
Maternal distress	5
Previous Cæsarean section	2
Severe toxæmia	2
Eclampsia	1
Cardiac disease	1
Diabetes	1
Pulmonary tuberculosis	1
Previous difficult forceps	1
Primary inertia	15

Most of the cases of delay in the second stage were occipito-anterior positions, but 30% were

due to occipito-posterior or transverse positions. The extractor proved useful in reducing maternal effort in those cases where this was limited by general medical conditions such as cardiac disease and pulmonary tuberculosis.

TABLE II.—PARITY

	No. of cases	Vacuum extractor successful
Primiparæ	53	41
Multiparæ	13	11

The higher incidence of extraction operations occurred in primiparæ as expected (Table II). The greater success rate in multiparæ is due to the opportunity of using a larger cup and therefore more powerful traction.

TABLE III.—STATION OF FŒTAL HEAD IN PELVIC CAVITY

	No. of cases	Vacuum extractor successful
High	5	2
Mid	28	21
Low	33	29

When the head is arrested high in the pelvic cavity there is usually some cephalopelvic disproportion, hence the failure of the extractor in 3 of these 5 cases (Table III). All 3 came to Cæsarean section, one after failure to deliver with Kielland's forceps.

TABLE IV.—CERVICAL DILATATION

	No. of cases	Vacuum extractor successful
Fully dilated	49	39
Anterior lip	3	2
4 fingers dilated	5	5
3 fingers dilated	7	6
2 fingers dilated	2	0

Of the 10 failures where the cervix was fully dilated 8 occurred in the first half of the series, while the failure in those cases where the anterior lip of cervix existed was also in the first group (Table IV).

TABLE V.—MECHANICAL FACTORS

		Occasions applied	Occasions successful
Diameter of cup	30 mm	2	0
	40 mm	46	35
	50 mm	18	17
Vacuum induced	0·5–0·7 kg/sq.cm	19	10
	0·7–0·85 kg/sq.cm	47	42

It was found that the degree of cervical dilatation was not the only factor determining the size of the extractor cup to be applied. Difficulty with introduction of the largest cup (50 mm diameter) into the vagina necessitated more frequent use of the medium cup (40 mm diameter). Greater success was obtained using the larger cup (Table V).

Early in the series, using a vacuum less than 0·7 kg/sq. cm delivery was achieved in only 53% while in the later cases negative pressures of 0·85 kg/sq. cm were used without damage to the babies and with 90% success (Table V).

TABLE VI.—TYPE OF ANÆSTHESIA

General anæsthetic	9
Pudendal block	49
Intravenous "cocktail"	24
Perineal infiltration	6
No anæsthetic	2

Table VI lists the type of anæsthesia employed. The indications for general anæsthesia were eclampsia, severe toxæmia and maternal distress. Extraction was more difficult and protracted under general anæsthesia where the maternal effort was absent.

TABLE VII.—RESULTS OF EXPERIENCE WITH VACUUM EXTRACTOR CUP

1st group of 33 cases	11 failures
2nd group of 33 cases	3 failures

Detailed analysis of the two groups showed the great improvement obtained by using a higher vacuum and with greater experience. Excessive traction caused avulsion of the cup accounting for most of the failures in the first group (Table VII). Of the 3 failures in the second group 2 were delivered by Cæsarean section and 1 by a difficult Kielland's rotation, resort being made to forceps as fœtal distress rapidly developed at full dilatation.

TABLE VIII.—MATERNAL MORBIDITY

	Primipara	Multipara
Episiotomy	84%	50%
Lacerations	4%	0%
Maternal mortality	0	0

Maternal morbidity (Table VIII) was assessed in terms of trauma during delivery. An appreciable number of multiparæ sustained no trauma during delivery and in no instance did the episiotomy extend up to the vaginal vault as is sometimes seen with difficult forceps deliveries. There were no third-degree tears of the perineum. As 6 of the 22 patients seen at follow-up clinics have subsequently become pregnant or had another child it appears that delivery by the vacuum extractor is no ordeal to the mother.

TABLE IX.—INFANT MORBIDITY

Scalp trauma: Superficial graze	8
Deep ulceration	Nil
Cephalhæmatoma (resolved in five months)	1
Convulsions in neonatal period	Nil
Perinatal mortality	1

Infant morbidity (Table IX) measured in terms of local trauma showed superficial abrasion in 8 cases which healed within a week with the application of gentian violet paint. The red ring marking on the scalp took up to three weeks to disappear. The cephalhæmatoma resolved in five months.

The perinatal death occurred on the fourth day. The delivery for delay in the second stage had not been unduly difficult. The 40 mm cup was in position for thirty minutes of which fifteen minutes was taken to deliver the baby by

intermittent traction. It weighed 8 lb 3 oz and progressed normally until the fourth day when respiratory distress and cyanosis rapidly developed and death occurred in a few hours. At post-mortem a blood clot was present in the posterior fossa of the skull, and a small tentorial tear was noted. There was no damage to the inner surface of the skull or underlying brain in the region of application of the cup.

A follow-up of babies over 1 year of age was most encouraging. 22 babies were seen, none showed any marking of the scalp or reduction of hair growth to indicate the site of application of the extractor cup. All the babies are developing normally.

The vacuum extractor has a place in the armamentarium of both the hospital and general practitioner obstetrician. Criticisms of the long application period of ten to fifteen minutes and rather horrifying artificial caput are of little moment compared with the advantages:

(1) One of the main applications of the vacuum extractor is that it can successfully be used in cases of inertia in the first stage of labour where the cervix has reached three fingers dilatation and there is an indication to complete delivery. Such cases might otherwise result in Cæsarean section. A forceps delivery, with or without incision of the cervix, carries a greater risk to both mother and baby.

(2) It is simpler to apply than forceps in the second stage of labour.

(3) It is free of risk of facial nerve injury to the baby.

(4) It is less damaging to the mother as there is less stretching of the vagina than with forceps.

(5) A general anæsthetic is not necessary, hence there is less maternal risk.

(6) The incidence of Cæsarean section is reduced without increasing the fœtal mortality.

(7) The patient remains conscious throughout and has the satisfaction of assisting in the birth process.

Acknowledgments.—I would like to thank Mr. J. V. O'Sullivan and Mr. A. C. H. Bell for their encouragement and permission to use the vacuum extractor on patients under their care.

Mr. C. H. de Boer (Liverpool) said that the vacuum extractor, like the obstetric forceps, was a method of getting hold of the fœtal head while it was still in the birth canal.

The obstetric forceps applied round the head gave a force, theoretically, to the base of the skull: the extractor grabbed the scalp and it was almost true to say that the baby was pulled out by its hair. If the baby's skull were a rigid structure as was the adult's, tension on the scalp could have no effect on the intracranial contents. As it was, there was a possibility of compression. In order to assess its effect a suction cup had been applied to the scalp of a fresh stillborn baby while a manometer registered its intraspinal pressure. The baby weighed 6 lb, was three weeks premature by dates and was lost because of a prolapse of the umbilical cord. The resting pressure was nil; after simple application of the suction cup, without any traction, the pressure rose to 25 cm of C.S.F.; it fell to 7 cm on releasing the vacuum and rose again to 25·5 cm on reapplication. Finally it fell slowly to zero.

In obtaining its grip on the fœtal scalp the suction cup compressed the skull and raised the intracranial pressure. This might be the last straw for a baby that was already distressed, and even for the undistressed fœtus, if this compression was maintained for a long period its cerebral circulation might be embarrassed.

Where this risk of raising the intracranial pressure was of no significance, for example in helping the delivery of a dead baby, the extractor would be safe. Another such example, from the field of gynæcology, was in the manipulation of ovarian cysts.

Dr. E. W. Lillie (Dublin) said that in his series of 70 cases, he had not been attended with the same success as that obtained by Professor Snoeck and had required forceps to complete delivery in 20. His results had not been influenced by the degree of dilatation of the cervix and equal success had been obtained with a 2 or 3 finger cervix as when the cervix was almost fully dilated. Similarly the station of the head did not appear to make any material difference in the absence of disproportion. However, he had found that the position of the head was extremely important and had had very bad results when the occiput was posterior.

He agreed with Mr. Chalmers that the vacuum extractor could not replace the forceps. He had found it of little value in the presence of moderate cephalopelvic disproportion. It had little place in the treatment of acute fœtal distress, for when this occurred in the second stage of labour, delivery could be effected more rapidly with forceps and in the first stage of labour Cæsarean section was usually more suitable. However, there were cases of doubtful or early fœtal distress in the first stage of labour when one was not inclined to perform Cæsarean section and one was rather anxious about allowing labour to continue. The vacuum extractor was then a most suitable answer. This, together with hypotonic inertia in the first stage of labour, was the main indication for the use of the vacuum extractor. To Mr. Smedley's list of subsidiary indications he added some cases of prolapsed

cord in the first stage of labour. He had encountered 2 such cases, 1 a multipara with a half-dilated cervix who was delivered safely within three minutes, and the other a primigravida also with a half-dilated cervix, in which the cord was replaced and delivery effected safely with the vacuum extractor.

One of the main disadvantages of the vacuum extractor was that it was generally very time consuming. It was unusual to complete a case in less than an hour. The question of trauma to mother and fœtus had been adequately dealt with, but trauma to the obstetrician had not been mentioned. This could be quite marked as considerable and prolonged effort was sometimes required to effect delivery.

Dr. J. R. Saunders (London) said he had used the Malmström vacuum extractor on 30 occasions. The indications for its use had been delay and fœtal distress, both occurring in the second stage of labour. In 23 cases the head had been in the mid-cavity and in 7 it had been at the outlet. In 2 patients the position was occipito-posterior and in 2 it was occipito-transverse.

In each case the patient was delivered in the lithotomy position after the insertion of a pudendal block. As the larger sizes of traction cup were less likely to become detached, an episiotomy was made before the application of the cup. This usually allowed the largest size, namely the 60 mm diameter cup, to be used.

By trial and error 0·6 kg/sq. cm was found to be a suitable vacuum when using the largest size of traction cup. The vacuum was increased in stages, allowing 90 seconds for each 0·1 kg/sq. cm change in pressure.

Once the cup had been securely applied traction was employed during the contractions. It was rarely necessary to pull during more than 4 contractions and frequently the head delivered after one or two pulls. Counter-pressure to the upper edge of cup, using the fingers of the left hand, was required to prevent the cup from slipping off.

On three occasions the fœtal heart had been monitored using a fœtal phonocardiograph during a vacuum extraction. This failed to show acceleration or slowing of the fœtal heart-rate and it appeared that the vacuum extractor did not cause fœtal distress. A tocographic record taken in a case of delay in the second stage due to uterine inertia showed that traction with the vacuum extractor stimulated uterine contractions.

There had been 3 failures in the series; 2 were associated with occipito-posterior positions which he had been unable to rotate with the extractor. The third failure was in a patient with a severely contracted outlet who should perhaps have been delivered by Cæsarean section.

None of the babies in this series had caused anxiety after delivery although 2 developed a cephalohæmatoma. The caput succedaneum usually disappeared within three days.

The vacuum extractor appeared to be a safe and efficient instrument. It was easy to use and might be of great value to general practitioners as well as obstetricians conducting an easy type of forceps delivery. Like all surgical instruments it had its limitations and he hesitated to recommend its use for a difficult type of forceps delivery.

He wished to thank Professor W. C. W. Nixon for his help and encouragement in the use of this instrument.

Mr. E. A. J. Alment (London) said that at St. Bartholomew's Hospital the vacuum extractor had been used in 10 cases in which Willett's forceps might formerly have been employed. In 4 out of 6 cases of uterine inertia cervical dilatation was accelerated by 4 lb continuous traction, and vaginal delivery achieved. 2 cases of Type I placenta prævia were also successfully delivered. The difficulty of applying the instrument through the incompletely dilated cervix was stressed.

Mr. John Frankenberg (Uxbridge) said that to the "Rocket" of the Malmström apparatus he wished to add his "Puffing Billy". This suction cup was made to his design in 1951 by the late Mr. van Leer of Messrs. Vann Bros. Ltd. It was in Coldlite. The vacuum was produced by a foot-operated, non-lubricated, vacuum pump, especially invented and made by Mr. R. P. Fraser at the Imperial College of Science. With this pump it was planned to obtain 27 lb pull with a 3 in. cup. Some 20 patients had been delivered using this device but he had found difficulty with it owing to air leaks and to the fact that the caput filled the cup very rapidly and destroyed the vacuum.

The most important improvement of the Malmström cup is the flanged rim which allows the formation of the "top knot" and so ensures a proper grip of the baby's head.

He thought that a combination of the Malmström cup with the Fraser pump would allow the obstetrician to work single handed and to control the vacuum himself.

He had previously only thought of his suction cup as a means of replacing the forceps and subject to the same indications; Mr. Chalmers had shown how useful vacuum cups could be in the first stage.

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(*contd. on p.* 780)

Section of Epidemiology and Preventive Medicine

President—Air Marshal Sir JAMES KILPATRICK, K.B.E., C.B.

Meeting
March 18, 1960

A Prospective Study of the Leukæmia Mortality of Children Exposed to Ante-natal Diagnostic Radiography

A Preliminary Report [*Summary*]

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FOLLOWING the publication in 1958 by Stewart, Webb and Hewitt of the results of their retrospective survey into X-ray exposure *in utero* as a possible ætiological factor in childhood cancer, we started a prospective survey of the mortality from leukæmia of children exposed *in utero* to diagnostic X-rays. In this study we were associated with Professor A. Bradford Hill, and had the invaluable help of Dr. E. Rohan Williams and other radiologists.

Material and methods.—The study is based on information from eight hospitals, four in London and four in Edinburgh. At each hospital lists were compiled of women who had had abdominal X-ray examinations during pregnancy, and who subsequently had been delivered in hospital. The lists related to X-ray examinations during the period 1.1.45 to 31.12.56 inclusive. From the relevant case records and from the birth records of the Registrars-General of England and Wales and of Scotland records were obtained of 39,166 live-born children of whom 20,987 were males and 18,179 were females.

Deaths ascribed to leukæmia in this study population were identified by checking our records against the lists of children certified to have died from leukæmia in England and Wales and in Scotland, during the years 1945 to 1958. These lists had been supplied by the Registrars-General to the Medical Research Council.

The national mortality statistics of England and Wales were used in the calculation of the expected number of leukæmia deaths in the whole population, due allowances being made for losses from the study population due to death and to adoption.

Results.—Altogether 9 deaths from leukæmia were observed whereas 10·5 were expected. 7 deaths were among males and 2 among females, the expected numbers being respectively 6·1 and 4·4. For children exposed during pelvimetry 4 deaths were found compared to 5·4 expected, and for those exposed during a single plain diagnostic X-ray examination of the abdomen the corresponding figures were 5 and 4·3. All except one of the children were irradiated during the last month of intra-uterine life, the single exception being exposed during the eighth month.

The data, therefore, as they stand show no evidence of any special leukæmogenic risk to the child associated with X-ray examination during the last two months of ante-natal life.

Discussion.—The results of this survey differ from those of Stewart and her colleagues (1958) and those of Ford and his colleagues (1959). In contrast they are in agreement with data reported by MacMahon (1958).

The results obtained by Stewart and her colleagues indicated that some leukæmogenic risk is involved to the child in ante-natal radiography, but it may be that the risk is not as high as was suggested, i.e. that the child exposed *in utero* incurs approximately twice the normal risk of dying from leukæmia or some other form of cancer before the age of 10. The finding by these workers of (1) a positive correlation between risk and the number of films taken, (2) a greater risk in early pregnancy, and (3) the greatest risk of all in association with abdominal X-ray examination supports the idea that a definite risk is incurred. On the other hand the histories of radiation exposure were obtained from the mothers of the dead children whereas the control histories were obtained from mothers of living children. A

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difference in recollection between the two groups may have introduced bias into the results, probably due to under-reporting of their exposure histories by the control mothers. The data of the closely similar retrospective survey of Ford and his colleagues (1959) also indicate the existence of some risk, but again the data on the exposure history of the mothers do not appear to have been obtained objectively. By contrast the data reported by MacMahon were all obtained objectively. MacMahon studied a 1% sample of 252,203 live births which took place in 11 selected maternity units in New York City between 1947 and 1954. He found that 7·3% of the sample children had been irradiated *in utero* and that a similar percentage of the 114 children who had died from cancer in the total study population had also been exposed *in utero*. These data, therefore, do not suggest any special risk.

In the present survey inaccuracies may have occurred in the identification of deaths; steps are being taken, therefore, to check the validity of the technique used. A second criticism is that the study population was derived from 8 metropolitan hospitals, where X-ray techniques are, from the point of view of radiological safety, above average. Finally the results may have been affected substantially by chance factors. Out of nearly 40,000 children studied only 9 deaths from leukæmia were found. With such a small number chance factors are relatively important. Thus if, based on an increased risk from radiation, the expected number of deaths had been as high as 16, then a finding of 9 or less due to chance alone would not have been surprising ($P = 0{\cdot}04$ An observed number of 16 would have indicated an excess risk of just over half that suggested by Stewart and her colleagues.

In conclusion it seems likely that if a leukæmogenic risk is incurred by ante-natal X-ray exposure, then the risk is almost certainly very small, and unlikely to be as great as double that to which the general population of children is exposed.

Acknowledgments.—We are most indebted to the members of the obstetrical and radiological staffs of the hospitals concerned for placing their records at our disposal.

We would also like to acknowledge the invaluable assistance of Mrs. R. Ash, Miss F. Callaby, Mrs. A. Frackiewicz, Mrs. E. A. O. Gray, Miss K. Jones, Mrs. M. Kidd and Mrs. V. Peetz of the staff of the Medical Research Council's Clinical Effects of Radiation Research Unit and Statistical Research Unit.

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Geographical Variation in Leukæmia Mortality in Relation to Background Radiation

Epidemiological Studies [*Summary*]

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IN a study of the distribution of leukæmia in Scotland, the country was divided into 10 areas—the 4 principal cities, 5 mainly rural areas and the rest of Scotland. Population estimates by sex and 10-year age groups were obtained for September 1939, April 1951 and June 1956 and mean populations for 1939–46 and 1947–56 were estimated by linear interpolation. The estimates were more accurate for the second period than for the first, because of wartime movements of population in the first period. The numbers of deaths expected in each of the 10 areas were calculated by multiplying the populations in each of the sex and 10-year age groups by the corresponding national sex and age specific mortality rates and summing for all ages over 15 years. Standardized mortality ratios for persons aged 15 years and over were obtained for each area by expressing the recorded numbers of deaths as a percentage of the number expected. The study was limited to the data for adults, as it was thought that any effect produced by background irradiation would be more likely to be manifested in this age group. The results showed that there had been an excess mortality for leukæmia in two areas—Aberdeen and Edinburgh—which could not reasonably be regarded as due to chance. In Aberdeen, with 134 deaths, the standardized mortality ratio (S.M.R.) was 146; in Edinburgh (with 305 deaths) it was 124. The S.M.R. was highest in Aberdeen for men and for women and for all persons in the period 1947–56. In the earlier period, when the population estimates were less accurate, the S.M.R. was less than in Edinburgh.

The Registrar-General for Scotland had provided copies of the death entries from leukæmia for all Scotland since 1939 in the course of an-

other investigation and it was, therefore, possible to make estimates of the mortality attributable to different types of leukæmia. Leukæmia of unspecified type was allocated separately in each sex and age group to one of three specified types in the proportion in which the specified types had been reported in the same sex and age groups in the same area; expected mortalities were calculated as previously from the data for all Scotland. The standardized mortality ratios for acute leukæmia, chronic myeloid leukæmia and chronic lymphatic leukæmia are shown in Table I,

TABLE I

Area	Standardized mortality ratio			Standardized death-rate from acute leukæmia and chronic myeloid leukæmia per million persons per year
	Acute leukæmia	Chronic myeloid leukæmia	Chronic lymphatic leukæmia	
Aberdeen	161	142	117	46
Perthshire	142	96	121	37
Aberdeenshire	121	94	100	33
Edinburgh	113	113	154	33
Banff, Inverness, Moray and Nairn	117	87	112	32
North Scotland	84	132	72	29
Dundee	95	103	125	29
Rest of Scotland	92	103	92	28
Glasgow	94	80	80	26
Angus and Kincardine	89	84	124	26

together with the standardized mortality rates for acute leukæmia and chronic myeloid leukæmia combined. From the data it is clear that the excess mortality in Aberdeen resulted principally from an excess of acute leukæmia and chronic myeloid leukæmia—that is, from the two types of leukæmia which are known to be capable of being produced by ionizing radiations—whereas the excess in Edinburgh was mainly due to an excess of chronic lymphatic leukæmia.

The mortality from chronic lymphatic leukæmia has increased sharply in the last twenty years in Britain and this increase has been limited to the older age groups (Court Brown and Doll, 1959). It has been suggested that the increase is primarily due to better case finding and this seems a reasonable explanation for much of the increase in Edinburgh. The mortality from leukæmia has been higher in the wealthier than in the poorer economic strata of the community (Registrar-General of England and Wales, 1958) and this factor may also have contributed to the excess in Edinburgh, which is a capital city, with a relatively high proportion of its residents employed in professional and administrative capacities.

The excess in Aberdeen may be explained in part by better case finding—since the last two professors of medicine had had a special interest in hæmatology—but there is no reason to suppose that it would have been influenced by any factors specifically associated with high social status. There remains the possibility that the excess may have been contributed to by an above-average exposure to ionizing radiations.

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Dose Rates from Background Gamma Radiation to Populations in Four Districts in Scotland[1] [*Summary*]

By F. W. SPIERS, D.Sc.

Leeds

SURVEYS of dose rate were made in two predominantly granite districts, Aberdeen City and Aberdeen County, and in two districts of sedimentary rocks, Edinburgh and Dundee. In all four areas most of the houses and buildings are made of local stone so that a sufficient homogeneity exists to give significance to a mean population dose.

Measurements of dose rate were made out of doors and in houses. The houses, numbering 155 in Edinburgh, 103 in Aberdeen and 71 in Dundee, were distributed reasonably evenly over the built-up areas of the cities and included the various types of building materials in representative proportions. In Aberdeenshire measurements were made in 172 houses distributed to take into account the variations in population density and local geology. In all areas about the same number of measurements were made on roads and pavements.

The measurements were made with a portable high-pressure ionization chamber having a high gamma-ray sensitivity and long-term stability. At each out-of-door site two measurements were made and in houses a mean was taken of six measurements, two being made at each of three selected points—the living room, kitchen and one upstairs bedroom. A correction was made

[1]The surveys were carried out with the assistance of Mr. M. J. McHugh of the Medical Research Council's Environmental Radiation Research Group in the Department of Medical Physics, The University of Leeds. A detailed account of the physical procedures will be published elsewhere.

to the measurements to allow for the cosmic-ray dose rate so that the dose rates reported are those arising from local gamma radiation.

TABLE I.— MEAN BONE-MARROW DOSE RATES

Radiation	Edinburgh	Dundee	Aberdeenshire	Aberdeen
	All dose rates in mrad/year			
Local gamma radiation (measured in air)				
Out of doors ..	48·5	63·0	69·5	104
In houses	60·0	67·2	81·5	85·3
Twenty-four-hour average	57·1	66·3	78·5	90·0
Dose rate to bone marrow				
Local gamma radiation	37	43	50·5	58
Other sources ..	43	43	43	43
Mean marrow dose rate	80	86	93·5	101

The dose rates out of doors and in houses are given in Table I. The mean out-of-door dose rate of 104 mrad per year in Aberdeen is more than twice the mean of 48·5 mrad per year in Edinburgh. In houses built of local stone the mean in Aberdeen (all granite houses) is 87 mrad per year and in Edinburgh (sandstone houses) 48·5 mrad per year. The mean dose rates for all the houses in the respective cities (*see* Table I) differ to a lesser extent, because the proportion of brick houses in Aberdeen lowers the mean dose rate to 85·3 mrad per year and in Edinburgh raises it to 60·0 mrad per year. The third line of Table I gives a "twenty-four-hour average" dose rate which is calculated on the basis that people spend three-fourths of their day indoors, and the fourth line gives the dose rate which is received by the bone marrow. This dose rate has been found by experiments with models to be about 64% of that recorded by the dose meter standing free in air. The fifth line of Table I states the dose rate which is received by bone marrow from sources other than the local gamma radiation; this contribution arises principally from cosmic rays and from the natural radioactive isotope potassium-40 which is present in the body potassium.

The total doses per year given in the last line of Table I show that there is a difference of 21 mrad per year between the mean annual doses to the bone marrow of the populations in Edinburgh and Aberdeen. This difference is a known measure with which other low dose rates can be compared.

Meeting
April 22, 1960

The Sources and Prevention of Mental Ill-health in University Students

By BRIAN W. DAVY, M.D., D.P.M.
Cambridge

OVER a quarter of a century ago J. R. Angell, who was then President of Yale, wrote "10 to15% of our college students suffer from some emotional or personality difficulties sufficiently serious to diminish very much their effectiveness and happiness" (Angell, 1933). At that time there would have been few, if any, in the universities of this country, and certainly no Vice-Chancellors, who would have made a similar statement about British students. But in 1959 Ronald Still, in a ten-year survey of the mental health of Leeds students, reported that of the 10,500 men and women seen by the University Health Service 14·7% "presented psychological symptoms of some degree of severity." In an analysis of one year's intake of degree students at University College, London, Malleson (1958) reported that 20% of them had handicapping psychiatric disorders of varying severity.

In a questionnaire to assess the incidence of psychological handicap in third-year Cambridge undergraduates (Davy, 1957), 15·5% of the sample studied answered that in addition to being frequently or constantly anxious they commonly felt depressed, apathetic, apprehensive, and under a strain, and uncommonly felt contented, self-confident, mature, optimistic or energetic. A quarter of these men had sought expert advice about their psychological problems and a further quarter said that they would have liked to have done so. This sample, taken in the men's third year, did not include those who had already left the university for various reasons including psychological difficulties.

At the First International Conference on Student Mental Health in Princeton in 1956 it was clear that although the universities represented differed greatly the incidence of psychological difficulty in their students was broadly similar and in keeping with Angell's earlier estimate (Funkenstein, 1959), a similarity probably due to the fact that University Medical Officers commonly approach their task from a functional not a diagnostic point of view, and try to decide not whether a student is sick or well but what are the causes of his symptoms or the reasons for his behaviour.

These findings do not always pass unchallenged. There are those who are surprised, and occasionally disturbed, to learn that over the past ten years in Britain most doctors in close

contact with students have become increasingly occupied with the psychological difficulties of an apparently healthy age group. It is said that healthy, intelligent young people ought not to need help of this kind, that the problems of youth are a necessary, healthy part of acquiring maturity, and that those who are unable to deal with them unaided do no more than reveal their own lack of fibre. But this is not the experience of anyone who is easily approachable, who is prepared to listen, and whose knowledge and experience of young people enables him to assess the significance of what he hears.

To practise medicine amongst students is to be forced to realise that some of them are handicapped, some seriously, by psychological difficulties which make it hard, or even impossible, for them to profit fully from the educational, social and athletic opportunities which the university offers. In Britain attention was drawn to the importance of student psychological disorder by Parnell at Oxford in a review of the three-year period 1947–49 which showed that of the 145 students who missed a term or more as a result of ill-health, 52·5% were suffering from some kind of psychological illness (Parnell, 1951). This represents a little over 1% of students and, as Parnell pointed out, must inevitably be a low estimate of severe disorder. Malleson, at University College, London, thought this estimate could be doubled or even trebled, and his own figures show an incidence of 4% of serious disorder. Ronald Still of Leeds gives an incidence of 1% of serious disorder and 4% of moderately serious disorder. At Cambridge the students who consult me with severe psychiatric disorders during their three years represent about 2½% of those at risk, but this is an underestimate of the true incidence.

It seems clear, therefore, that probably about 4% of students are liable to severe psychiatric illnesses and about 10–15% to lesser, though handicapping, disorders. The severely ill need specialized psychiatric treatment, some in hospital; the less severely ill commonly need help of some kind. Their own unaided efforts and the therapeutic value of their growing experience of life are not always enough; the psychological difficulties of some students insulate them from the experiences which could teach them to overcome their problems.

The present paper is based upon experience of students in Cambridge. Cambridge is not typical of British universities as a whole and has important differences in addition to the more obvious ones of a collegiate system and a long-established tutorial system of teaching and supervision.

With the exception of London University with its widely scattered institutions Cambridge is the largest university in Britain, with about 8,600 students, of whom about 7,300 are undergraduates taking a first degree. Of these only 1 in 11 is a woman (University Grants Committee, 1959). Within the university itself the proportion of students from overseas is comparatively small—of 8,600 students about 550 are from the Commonwealth and a further 320 from other countries abroad. About 52% of the men live in college or in college hostels, 47% in lodgings, and only 1% live at home. Of the women, 6 out of 7 live in college and only a very few at home. 55% of undergraduates are reading arts subjects, 42% science, and 3% other subjects.

An examination of some kind is taken by the great majority of undergraduates at the end of each year. It is relatively uncommon for a man or a woman to leave the university without a degree. This is partly due to the relatively high academic ability of the applicants and partly to the examination system, in which a man who fails to reach the necessary standard for an Honours degree may be allowed an ordinary degree. For example, of 497 men who joined five colleges as undergraduate freshmen in 1951, 23 did not complete the course (6 on account of ill-health, 2 because they interrupted their careers with the intention of returning later, and 15 who went down, or were sent down, on account of unsatisfactory work). Of the remainder 472 sat their final examinations (2 were ill, and only 7 failed completely. Thus, of the original 497 men, only 30 (6%) failed to graduate at the end of their three years. 94% graduated in the normal time; a sharp distinction from 73·5% at University College, London (Malleson, 1958), and 71·1% reported in a survey of Liverpool students (Mountford, 1956).

About 52% of Cambridge men previously attended a public school or, more precisely, an independent school the headmaster of which is in membership of the Headmasters' Conference. The comparable figure for all male students admitted to British universities is 21% (Kelsall, 1957). At Cambridge 23% of men are from Local Education Authority grammar schools compared with 67% for the country as a whole.

The fathers of a little over 1 in 3 of Cambridge undergraduates have had a university education and three-quarters of them are in the professional-managerial group. 9% of Cambridge undergraduates come from working-class families compared with 28% for British universities as a whole. One in 6 of Cambridge undergraduates has no scholarship or grant, and of those who have college scholarships or exhibitions, which by present-day standards are not substantial, by no means all are supplemented by State Scholarships.

Although the position is now changing, in 1958 about half the male undergraduates had completed their National Service before entry into the University.

The Incidence of Psychological Difficulty Amongst Cambridge Students

There are many difficulties in collecting reliable figures on this subject from any community. They are as great in a collegiate university where colleges are under no obligation to reveal such information, and there is no central authority with the responsibility of compiling such statistics. In Cambridge it is necessary to use estimates and the clinical experience gained in providing and developing psychiatric facilities for students.

The seeds of a psychiatric service for students were sown in 1951 when it was decided to appoint an additional doctor in the University Health Service to pay particular attention to the environmental and psychiatric aspects of student health.

The mental health facilities available were not advertised in the University and at first the majority of cases seen were those discovered at the routine physical examination undergone by about 90% of freshmen. As students, tutors and general practitioners found that psychiatric help was available in the University Health Service, direct approach was made in increasing numbers, so that in 1957–58, 184 men and women were seen, of whom 152 were new patients. Approximately a quarter were referred by tutors, a quarter by general practitioners, and a third were self-referred. The remainder came from the routine medical examinations or other referrals (Rook, 1959).

That a third of the cases were self-referred needs some comment. It is sometimes suggested that the provision of student mental health facilities encourages weaklings to seek help unnecessarily, and that those who make a direct approach unsponsored by tutor or general practitioner are likely to include a greater proportion of such patients. Examination of the case papers of the self-referred students revealed that they were at least as ill as those referred by tutors and general practitioners.

A rate of 152 patients a year means that about 1 student in 19 is likely to be seen during his or her three years of University residence. This represents only a proportion of those actually in need. Some do not seek help—at least while students—others go to doctors and psychiatrists in their home town during vacation, some are dealt with by general practitioners and other psychiatrists in Cambridge, and an indeterminate number carry their problems to tutors, chaplains, parents and senior friends. The proportion of women to men patients is greater than the proportion of women to men in the University, but the figures are small, although Still at Leeds made the same observation.

The Types of Cases Seen

Psychoses (almost exclusively schizophrenia) account for 6 to 7% of the cases; the ? psychoses (some of whom undoubtedly will develop into frank schizophrenia later), a further 6%; neurotic illnesses of all types and degrees of severity, but mainly the anxiety states with or without accompanying physical symptoms, about 40%; the character or behaviour disorders, 20%; the severe sexual abnormalities (i.e. the confirmed homosexual, sadomasochist, transvestist and fetishist) about 12%; 1 or 2% are stammerers; finally a group with long-standing depression which accounts for about 12–14% of cases and contains, in addition to some neurotic depressions and depressions associated with severe character disorders, a hard core of chronically and severely ill people, grievously handicapped and very resistant to treatment, at least a proportion of whom prove to be insidiously developing schizophrenias.

About 7–10% of the young men and women seen have to enter hospital or nursing home in Cambridge or at home. Cases classified as severe make up about 50% of those seen. Malleson from University College, London, gives 24%, Read from the London School of Economics 21% (Read, 1954), Farnsworth from Harvard and Massachusetts Institute of Technology 26% (Farnsworth, 1957), and Still in Leeds gives 6·5% as severely ill and 35% as moderately severely ill. The higher Cambridge figure is probably due to the fact that student patients are now seen in the psychiatric department of the United Cambridge Hospitals and there are inevitably fewer milder cases than in the figures quoted from other universities and colleges.

Sources of Student Mental Ill-health

In considering the occupational hazards of student life I do not suggest that these are the fundamental causes of psychological disorder but they do increase the disability of those already disturbed.

Sir Eric Ashby, when Vice-Chancellor of Belfast University, read a paper to the annual conference of the British Student Health Officers Association in which he discussed the four elements with which students have to contend in the transition from school to university (Ashby, 1958). These are important not only during the period of transition but are the principal mental health hazards throughout the students' university years. They are:

(1) A diminution of personal responsibility and importance.

(2) A relaxation of controls over discipline.

(3) Unfamiliar methods of study.

(4) A new set of loyalties which make greater demands than those at school.

A diminution in personal responsibility and importance.—The boy whose insecurity was kept at bay by academic, social or athletic prowess at school may find in the relative anonymity of the University just how dependent he had become on the reassurance of the eminence he had had at school.

Undergraduate patients, when asked how they got on at school, sometimes reply "Too well", revealing their awareness of the unwelcome change in their status. This removal of personal responsibility and importance may leave the student feeling ineffectual and a failure, convinced that he has made a mistake in aspiring to a university education.

The relaxation of control of discipline.—In an atmosphere of unfamiliar freedom the insecure student feels not free but alone, missing the familiar, reassuring controls. The man or woman with a psychosexual disorder, or the fear of one, may become worse away from the restraints and the tacitly accepted standards of home; the man with a character disorder who has had difficulty in getting on with others in the enforced intimacy of school may retreat into himself, or, if he resented authority, he may feel that in Cambridge authority is now not interfering, but apathetic toward him. As one man bitterly remarked "It was all right in the Navy, if you punched a petty officer in the eye you knew where you were and what to expect—here you don't".

Unfamiliar methods of study.—For many this is an initial source of anxiety and for others the cause of difficulties which continue throughout their student years. At school the insecure boy may grow dependent upon a method of work which earns the approval of teachers, reassures him, and can be relied upon to get him through examinations. Work is fed to him in measurable amounts, he is examined and assessed frequently and in revising for examinations he knows what he must learn. At the university he has less contact with his teachers, little direction of his work, and no regular assessment of his progress. His syllabus is so wide that he cannot know it all, and although encouraged to develop a critical selective ability he may be worried by what he does not know and either try to learn it all as at school, or, paralysed by the magnitude of the task, he may be unable to start. To his surprise he may find that he is losing interest in his subject and may seek to change it.

He misses the encouragement and the criticism of his schoolmasters and may try to make a schoolmaster out of his tutor, or attempt to organize his studies alone in the old, familiar, reassuring, but now inappropriate way. He may work long hours, become overtired and inefficient and so too exhausted or too frightened to take the examination. In contrast another may be misled by the absence of pressure from his seniors and do far less work than is necessary, having before relied on either being driven or on getting good marks easily.

The development of a new set of loyalties.—The healthy adjust as they adjusted to earlier important periods of development, but the psychologically handicapped are set particular problems. The conflict between home and university standards of culture, behaviour and morality may be acute and productive of anxiety and guilt, resulting in a withdrawal from university life or a compulsive excessive plunging into it. The student may attempt to maintain dual standards, being one person at the university and another person at home, and unable to let either meet.

In the provincial universities, where a third or more of students live at home, this problem is more acute, as it is for students from abroad, but it is by no means absent from the predominantly residential universities. In Oxford and Cambridge there is, for some, the additional difficulty of adjusting to colleagues from different financial and cultural backgrounds, although this is less of a problem now than it was.

I am commonly asked whether it is principally the grammar school boys who are troubled, but this is not my experience nor I believe that of college tutors. In the last 200 cases seen, a little over a third of the men came from public schools, and it will be recalled that, in Cambridge, public school boys account for about half the male undergraduates. Public school boys probably have as many problems, but some of them have been taught to conceal them effectively and to carry on without seeking help. Whether or not this is a good thing is a matter of opinion.

Some of the broad elements of university life which predispose to psychological difficulty have been given. However, one must also look outside the university environment to earlier family relationships. Repeatedly the family history of student patients contains striking evidence of anxiety-producing, confidence-reducing, resentment-provoking relationships. The scene is commonly set long before the man or woman arrives at the university.

Prevention—The Reduction of the Incidence of Severe Psychological Illness and Handicap in the Student Community

Selection.—There are three groups of students who should probably be discouraged from seeking a university place.

One is the clever student with no particular wish to go to a university, perhaps with a clear ambition to do otherwise, who is persuaded by ambitious parents or teachers that it would be foolish to miss the opportunity which their intellectual capacity could win for them. They are persuaded, they win their place, but they may lack the firmness of purpose necessary to deal with the university course.

Second is the boy or girl with a good academic record but with a strikingly unsatisfactory record in all other aspects of school life. At a university, if they have high intellectual ability, they may continue to do well in their work and be content to take no part in other university life. But if their academic success at school was gained with only average intellectual ability and the diversion of time from all other school activities to work, they are in danger of breakdown at the university where hard work alone is not enough. The exclusion of such candidates is difficult, and where entry is by examination alone it is impossible. Headmasters are probably in the best position to help, although they may have difficulties with ambitious parents, and not all headmasters can resist the temptation to get as many university places for their school as possible.

Relevant to this are certain differences noted between Cambridge students studying vocational subjects like law, engineering and medicine, and those studying the more academic subjects like English, history, modern languages and, to a lesser extent, natural sciences. Amongst students studying academic subjects the incidence of psychological illnesses is above expectation, particularly the neurotic illnesses with somatic symptoms, hypochondriasis and phobias, and there is a correspondingly lower incidence amongst those whose subjects specifically lead towards a career. It may be that the man who wants to be a doctor, lawyer or engineer has the ambition first and then makes the best use he can of his academic ability. In the academic subjects, however, there will be a number of students who compensate for social or athletic ineptitude or frank neurotic difficulties by diverting all their energies to academic work and gain university places as a by-product of these displaced energies.

The third group of students who should be discouraged from coming to a university are those with a history of recent severe psychological illness. I have seen a number who were actually advised to spend three years at a university to convalesce. General practitioners and psychiatrists without recent experience of university life commonly underestimate its present-day stresses, and college authorities are sometimes too ready to accept a medical certificate of fitness unaccompanied by a detailed report. Rarely are arrangements made for medical supervision to continue at the university. At times, of course, the fact that a student has had a serious illness is concealed from the university authorities by the patient himself.

Of the schizophrenic or suspiciously schizophrenic undergraduates 25% had previously been treated for earlier attacks of schizophrenia or schizoid illness and another 25% had had symptoms suggestive of developing illness. As far as is known none of these sought or was placed under any kind of medical surveillance when he came to the university. Two of them had had acute breakdowns during National Service and had been discharged. On the other hand undergraduates who developed schizophrenia whilst in residence, went away for treatment, and returned to the university under supervision, have avoided relapse, at least while at the university.

In general, however, selection should not be employed as a method of reducing the incidence of mental ill-health. Medical assessment should follow, not precede, acceptance, and save in exceptional circumstances medical disability should not exclude a student. The position is perhaps a little difficult in the mental health field where there are no clear-cut distinctions between the sick and the well, the abnormal and the normal, but it is surely preferable that a number of potential casualties be admitted than that some worthwhile, perhaps outstanding, students be excluded on suspicion.

Medical supervision.—Once a man or woman is admitted to a university it is essential that their past medical history should be known so that supervision may be arranged if necessary. Doctors, usually the university medical officers, are the proper recipients of medical reports which, with adequate safeguards of the students' confidence, can be made a condition of coming into residence. The reports should be from three sources—the parents, the school doctor and the home practitioner. Each is likely to provide details unknown to the others. University medical officers are then in a position to know at least some of the freshmen likely to be seriously at risk and to make provision for them.

A questionnaire completed by the student on coming into residence is useful but likely to be incomplete and inaccurate. Routine medical examination in conjunction with a completed questionnaire is better but expensive and there is still disagreement about the value of the routine medical examination of students. Some universities have never started them, others have given them up. In Cambridge with the exception of defective vision and carious teeth the number of remediable physical defects discovered at routine medical examination scarcely justified the expenditure in time and money.

Education.—This includes the health education of the student and the training of university teachers in psychiatric first aid. The difficulty to be overcome is that both tutor and student are often confident that they know the cause of the student's problems. The tutor blames lack of industry or ability, the student his own incompetence or that of his teachers. This occurs not only in the milder problems but also in the insidiously developing severe illnesses in which the student and his seniors may persist in a desire to explain away the manifestations of serious disorders of mood and thought as perversity or a transient reaction to difficulties, which are more often the effects of the illness than its cause. On the whole, the undergraduates need less education in their attitudes to mental health and illness than their seniors, but with a growing awareness of the effect of psychological disorders some university teachers ask for instruction in the earlier detection of disturbances in their pupils.

The mental health education of university teachers by formal methods has been tried and groups of them, similar to Balint's (1957) general practitioner groups, have been formed, particularly by the late Leo Berman in the United States (Berman, 1953) but I find that discussion with teachers about their problem pupils as they arise is the most useful and at present the most practicable method. This sort of health education is primarily the inculcation of an attitude of mind enabling the tutor to recognize that inappropriate behaviour is not always stupidity or wilfulness but may be a danger sign, e.g. the scholar who gets a third, the conscientious man who fails to submit essays and claims that he spends long hours at his books but gets nothing done, the man who should be developing a mature attitude towards senior members but instead treats them like schoolmasters or enemies.

The provision of adequate help.—Adequate diagnostic and treatment facilities should not only exist, they should be known to exist, and their method of use known to both junior and senior members of the university.

Psychiatry has an important specialized part to play in counselling and treating students and advising university authorities, but the tutor, the chaplain, the general practitioner, the older friend and the more senior contemporary are all traditional and essential sources of help for students in distress. The student should feel free to approach any of them, and, most important of all, those in positions to give help of this kind should know each other, so that referrals between them can easily and appropriately be made and problems discussed. In this way a flexible, informal, but efficient organization can develop so that those in need of help will receive it and receive it early.

Undergraduates are of an intelligence and an age most likely to profit from advice and treatment and in consequence the effective ascertainment and treatment of the psychologically distressed student is proving to be one of the most important tasks and opportunities in the student health field.

Acknowledgments.—I am indebted for many figures to the Undergraduate Survey carried out in 1959 by the University Sociological Society (Rees, 1959).

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Meeting
May 20, 1960

A JOINT MEETING was held with the Section of Comparative Medicine when a discussion took place on **Myxomatosis in Britain.** A general introduction was given by Dr. C. H. ANDREWES, Mr. H. V. THOMPSON spoke on **Epizootiology** and the Hon. MIRIAM ROTHSCHILD on **Entomological Aspects.** Mr. M. CRAWFORD, President of the Section of Comparative Medicine, was in the Chair.

Meeting
June 29, 1960

MEETING AT THE ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN, HERTS

Dr. C. C. SPICER and Dr. F. YATES presented a programme on **The Use of Electronic Computers in Epidemiological Studies.**

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Section of Odontology

President—Professor F. C. WILKINSON, C.B.E., M.D., F.R.C.S., F.D.S.

Meeting
April 25, 1960

ODONTOLOGICAL SOCIETY COMMEMORATION LECTURE

Cancer of the Oral Cavity from the Dentist's Point of View

By Professor E. HUSTED, M.D.
Copenhagen, Denmark

MORBIDITY and mortality from cancer are increasing steadily and despite very extensive and intensive research work both in the purely clinical and the more theoretical experimental fields, knowledge of the ætiology is still extremely limited. Genuine cancer prophylaxis is therefore impossible at present though some forms of cancer may be limited if certain factors causing marked local irritation which are considered to be significant contributory causes in the development of cancer, are excluded or reduced. As an example of current interest, the significance of tobacco smoking in the development of pulmonary cancer may be mentioned. Where cancer of the mouth is concerned also, there is considerable evidence that various forms of indulgence in tobacco and other local irritants play a certain part although other unknown and more generalized endogenous factors must be presumed to dominate. In this connexion, meticulous and rationally conducted oral hygiene with elimination of all factors causing local irritation must be given a certain significance.

The dentist's opportunity for co-operation in combating oral cancer is, however, primarily at the diagnostic level.

With the methods of treatment available at present, viz. radiation therapy and operative treatment, it is imperative that treatment should be started as early as possible. Treatment of primary tumours yields much better results when the tumour is small and has not infiltrated extensive regions of tissue. The prognosis becomes very serious when metastases in the regional lymph nodes are present and distant metastases, primarily to the lungs, make radical therapy impossible.

In many cases of cancer considerable time elapses before the patient comes for treatment so that at the beginning of treatment there is an extensive primary tumour and regional or even generalized metastases; this may be either because the patient has delayed in seeking medical advice or because too long a period has elapsed between the first examination and the correct recognition of the nature of the condition.

By means of generalized information, attempts are being made to get patients to seek medical advice as soon as they suspect that something is wrong. However, cancer in certain situations and the paucity of symptoms at the early stage of the disease are such that even the patients who seek medical advice "immediately" actually come for investigation when the disease is relatively far advanced.

Prophylactic examinations similar to Mass Miniature Radiography for tuberculosis cannot, as a rule, be carried out as the necessary investigations are so comprehensive and time-consuming that neither from an economic point of view nor with regard to the knowledge at present available can they be carried out as an ordinary measure. Immediate action and energetic investigation must, therefore, be limited to the cases in which suspicion of the presence of a tumour has been aroused by one means or another. Where tumours are accessible to direct inspection the conditions in this respect are much more favourable. The chances of early diagnosis of cancer of the mouth will be increased considerably when all dentists are aware of the occurrence and the clinical picture of this condition in the early stages and the important significance of the time factor. Early cancer in certain locations of the oral cavity may well simulate simple diseases of the soft tissues for which the dentist's advice is normally sought, and thus be brought first to his notice. Not only

this, but many individuals consult their dentists routinely at intervals of 6 to 12 months for investigation for diseases of the teeth and without feeling ill. Thus the possibility of comprehensive prophylactic examination for tumours and, in particular, cancer of the oral cavity is established. If the dentist extends his investigation to cover not only the teeth and parodontal tissues, but also the oral cavity as a whole, lips, cheeks, palate, tongue, sublingual region and the part of the throat available for inspection, the investigation will be prolonged by only a few minutes if nothing is wrong; where something suspicious is found more detailed investigation will reveal a malignant condition much earlier than would otherwise have been possible.

A considerable disadvantage of the very active propaganda for investigation in view of cancer is the risk of producing cancerophobia; with the popular point of view regarding malignant disease and its serious course, it is understandable that even the suspicion of the disease is, for most people an overwhelming and in many cases irrevocable tragedy. Cancerophobia is thus also a significant addition to the continually increasing number of neurotigenic factors of the present day.

Meticulous examination of the oral cavity as mentioned above in connexion with routine dental investigation may, however, be carried out without giving rise to anxiety in the patients; where something suspicious is found so that it is necessary to refer the patient for more detailed and special investigation, it is important that this is done as tactfully and considerately as possible without alarming the patient unnecessarily but also so that no valuable time is lost.

Symptomatic treatment carried out for a prolonged period when the diagnosis is uncertain is one of the most serious errors which can be committed. Out of 38 patients in the Maxillo-Facial Unit at the University Hospital, Copenhagen, suffering from gingival cancer, rational treatment was commenced immediately in 23 while in 6 cases two or three months had elapsed and in 5 cases between four months and more than one year had elapsed with palliative, symptomatic local treatment. This point is illustrated by the following 2 cases, recently treated in the hospital.

Case I.—Male, aged 59. Admitted to the Maxillo-Facial Unit on account of ulceration in the left side of the mouth. Three months previously he had noticed increasing looseness of the teeth in the left lower jaw and "swelling" of the gum developed which he interpreted as a gumboil and for which he consulted his dentist. As the condition of the teeth was on the whole poor, total extraction was undertaken a few days later. The swelling, however, did not disappear and the prosthesis made later was arranged to accommodate this.

As the condition did not improve subsequently, the patient consulted his doctor who referred him to the local hospital with a diagnosis of osteitis of the mandible—? tumour. Some tissue was removed by curettage and microscopic examination revealed the diagnosis of cancer and the patient was therefore transferred to the hospital.

On admission, a raised limited area of ulceration with a deep central crater corresponding to an alveolus was found in the left side of the edentulous lower jaw, corresponding in position to the canine to first molar. The process was indefinitely delimited and infiltrating but did not extend into the floor of the mouth or vestibulum. There were no enlarged lymph nodes in the submaxillary region or in the neck.

X-ray examination revealed massive destruction of the mandible corresponding to the lesion of the gum.

The tumour was extirpated with resection of the lower jaw and a radical neck dissection was done.

Case II.—Male, aged 61. Referred by his dentist to The Dental College in Copenhagen. Six weeks previously, he had experienced pain in the left lower jaw which he associated with a bad tooth. He, therefore, consulted his dentist who extracted the tooth in question. As the symptoms did not disappear, the patient consulted his doctor who administered penicillin which, however, did not influence the condition either. Eventually, X-ray examination was undertaken and the result caused the dentist to send the patient for specialist investigation.

In the left lower jaw the teeth from first incisor to first premolar were found to be in shocking condition. Distal to the fifth tooth and extending to the retromolar trigonum there was a large cauliflower-like papillomatous area on the mucous membrane adherent to the underlying bone, extending outwards into the alveolo-buccal sulcus and measuring 3 × 4 cm. There were no palpable lymph nodes under the margin of the jaw or in the neck.

X-ray examination revealed extensive destruction of the underlying bone corresponding to the changes in the gum.

The diagnosis of gingival cancer was confirmed by microscopic examination and extirpation of the primary tumour was undertaken with resection of the mandible and dissection of the nodes in the neck.

Cancer of the mouth is not frequent. In Denmark, approximately 125 new cases of genuine cancer of the mouth occur annually and slightly more (approximately 150) cases of cancer of the lips. Thus, the majority of dentists will only see isolated cases or perhaps none at all during many years of practice. Even though the problem is thus quantitatively very limited, the matter is extremely serious for the individual patient so

that all measures available must be employed to ensure the diagnosis as early as possible.

As a rule, in the early stages, the disease does not show any clinical symptoms which are so characteristic that it is immediately possible to establish the diagnosis. A great deal depends upon the experience of the investigator and his clinical sense and that in cases in which the course is not quite simple he considers the possibility of the presence of cancer.

From an odontological point of view, *gingival cancer* is of special interest in view of the differential diagnosis from the simple conditions of the parodontal tissues. Patients with gingival cancer frequently consult their dentist when they notice the first symptom of loosening of one or more of the teeth and interpret the condition as "pyorrhœa" or "inflammation of the gums."

Gingival cancer occurs most frequently in the lower jaw and particularly distally where the retromolar trigonum is a typical site. The patients are most frequently elderly or old and often edentulous but younger patients and even children may be affected with gingival cancer. In the early, and diagnostically important, stage the appearance is frequently quite uncharacteristic and may merely be a little nodule or ulceration, possibly only a fissure localized typically in an area of leukoplakia or a little flat or papillomatous tumour. A certain hardness of the tissue and particularly in the surrounding infiltrated tissue is characteristic of the malignant lesions and *palpation* is, therefore, a very important part of the investigation which should never be omitted. During the continued growth of the tumour, it will, as a rule, become adherent to the underlying bone and invade this; the teeth situated in the vicinity frequently loosen and for this reason the lesion is occasionally regarded as an ordinary chronic periodontal disease for a period. In dental practice, the greatest risk of confusion is primarily with simple ulcer formation, viz. pressure sores and parodontal conditions of inflammatory nature, because spontaneous loosening of the teeth in the neighbourhood of the tumour frequently occurs.

Benign conditions of various types such as inflammation and swelling occur much more frequently than malignant conditions and these present, as already mentioned, no such decisively characteristic symptoms that the diagnosis can be based upon them with certainty. There is, therefore, a considerable risk that early cancer of the mouth is not recognized so that the diagnosis is not made until too late. If the clinical picture of a presumed simple benign condition is atypical and peculiar and if the course does not conform with that anticipated under the ordinary forms of treatment, the diagnosis should be reviewed in time, supplementary investigations should be undertaken and specialist opinion should possibly be sought.

Pressure sores, caused in particular by pressure from prostheses but also by carious or broken teeth, occur frequently and the risk that a cancer in a patient with artificial teeth be mistaken for a pressure sore is considerable, particularly so when the first complaint the patient makes is that the prosthesis is uncomfortable. When the supposed source of pressure is removed, e.g. by removal of the prosthesis, a pressure sore should rapidly become clean and heal. If a definite tendency towards healing is not observed in the course of approximately a week, the ulcer should be suspected of being malignant and the diagnosis established by biopsy.

Biopsy.—The final decision regarding the nature of the pathological changes and in particular the possibility of malignancy cannot be obtained, as mentioned previously, until a microscopic examination has been undertaken. Even where the clinical picture provides the experienced observer with considerable evidence that cancer is concerned, microscopic confirmation of the diagnosis is, as a rule, necessary as the basis for planning the frequently very comprehensive treatment. The histological picture also influences the choice between operation or irradiation. The greatest significance of biopsy is, however, that in many cases it is the only certain method by which malignancy can be excluded in uncharacteristic and possibly apparently quite simple changes.

Biopsy should be undertaken in all cases in which clinical investigation has raised suspicion of malignancy or in which, during the treatment of a supposedly simple condition unexpected or atypical findings are encountered which do not fit in with the original diagnosis. The ideal requirement that the nature of tissue removed should always be confirmed by means of microscopic examination can scarcely be fulfilled outside hospital departments and similar institutions, but the requirement that all suspicious tissue, and tissue from cases in which the operation or the course of the disease reveals anything atypical or unexpected, should be submitted to microscopic examination should be a *sine qua non*.

If a dentist from his clinical examination of a patient suspects the presence of cancer, he should *not* perform a biopsy but refer the patient immediately to a specialist who can best administer the treatment. If, however, the nature of an apparently simple condition is unknown or if something unexpected is found, possibly at

operation, and the dentist does not feel absolutely sure that cancer is not present, microscopic examination should be undertaken without further delay. While awaiting the result, the dentist should plan the action to be taken if the diagnosis of cancer is confirmed so that no further time is lost.

The treatment of cancer of the oral cavity is a very exacting specialty in which the dentist's co-operation is not infrequently required but for which he should, under no circumstances, take the sole responsibility. While the diagnosis is the concern of everyone who undertakes treatment of conditions in the mouth, the treatment of cancer of the mouth is a decidedly special task which should be centralized, as far as possible, in units where not only adequate clinical experience but also both radiological and operative treatment are available.

The choice between radiological or operative or possibly combined treatment is made with reference to the histological structure of the tumour, its presumed sensitivity to radiation, its situation and the local extent and the presence of possible metastases.

The Role of the Dentist in Combating Cancer of the Oral Cavity

As mentioned previously, the task of the dentist regarding cancer of the oral cavity is primarily diagnostic. Even though cancer of the oral cavity is extremely rare as compared with the simple benign conditions seen daily in dental practice, the dentist should be observant of any suspicious findings. Easily aroused suspicion and subsequent more detailed investigation are the primary conditions for early diagnosis.

If, on the basis of the ordinary clinical investigation or on account of the course of a condition originally interpreted as simple, the dentist has reason to doubt his diagnosis he must, either personally or by referring the patient for specialist consultation, attempt to establish the diagnosis and to determine whether or not cancer is involved. As regards the question of microscopic verification of the diagnosis, reference is made to the remarks already made concerning biopsy but, as a general rule, the significance of determining the nature of the tissue removed at operative intervention in all cases is emphasized.

Oral hygiene is frequently poor in cancer patients. It is improbable that the condition vaguely called "oral sepsis" *per se* is a significant cause of cancer but it may be conceived that various locally irritating factors may contribute towards the development of the disease in predisposed individuals. On the other hand, an ulcerating or more or less copiously secreting tumour creates great difficulties in the maintenance of oral hygiene.

If the dentist finds indications for *extraction of teeth* or remnants of teeth in a patient suspected to be suffering from cancer, he should not perform the extraction until the diagnosis is established; if the diagnosis of cancer is verified, the extraction should only be carried out in collaboration with the surgeon responsible for the treatment of the tumour. Following extraction in the vicinity of a tumour, there is a great risk of rapid growth of the tumour with deep invasion, and extraction should therefore not be undertaken until the actual treatment of the tumour is planned and in connection with this treatment.

When a patient suffering from cancer in the oral cavity is to receive *radiation therapy*, very special problems arise regarding the teeth. In the regions within the radiation field, all teeth should be removed irrespective of their condition. The extent of the extraction and the appropriate time must be established in collaboration with the radiotherapist. Firstly, teeth in the vicinity of the tumour render the actual treatment difficult and, on account of secondary radiation, their presence makes the dosage uncertain; secondly, the teeth are destroyed by radiation so that they rapidly disintegrate and, at this period, particularly in the lower jaw, extraction is frequently associated with a considerable risk. This is due to the so-called *osteo-radionecrosis* or radiation necrosis particularly of the mandible. In bony regions exposed to heavy radiation therapy, even a minimal intervention such as the extraction of a tooth destroyed by radiation therapy may give rise to severe necrosis which, should infection supervene, may threaten the patient's life. In patients who have previously received radiation therapy for conditions in the oral cavity even the apparently simplest dental extraction should, therefore, not be undertaken, whatever the indications, until information has been obtained concerning the extent of the treatment administered and in collaboration with a surgeon experienced with this region.

Further, the co-operation of the dentist may be of considerable significance not only in the pre-operative *toilet* of the oral cavity but also in the preparation of a *resection prosthesis*. Prosthetic treatment is an important and frequently very exacting part of the reconstruction essential following the more comprehensive operative interventions so that these can produce a result acceptable to the patient both functionally and æsthetically.

[44 colour slides were shown.]

Meeting
May 23, 1960

MEETING AT THE ROYAL COLLEGE OF SURGEONS,
LINCOLN'S INN FIELDS, LONDON

Ivory

By A. E. W. MILES, F.D.S., L.R.C.P., M.R.C.S., and J. W. WHITE, L.D.S., R.C.S.
London

MOST dental or odontological museums contain considerable quantities of ivory and the Odontological Museum of the Royal College of Surgeons is certainly no exception. At a very rough estimate the total quantity of ivory in the collection must weigh at least a ton.

Chronologically it is appropriate to mention first a specimen in which we take great pride (Fig. 1). It is certainly the oldest specimen in the collection and is of topical interest because this is the year of the Tercentenary of the Royal Society. The specimen originally belonged to the Royal Society and was described by Grew (1681) in the following terms:

"A spiral or wreathed tusk of an elephant. Presented from the Royal African Company by Thomas Crispe, Esq. It is twisted and wreathed from the bottom to the top with three circumvolutions standing between two straight lines. 'Tis also furrowed by the length. Yet the furrows surround it not as in the horn of the Sea Unicorn, but run parallel therewith. Neither is it round as the said horn, but somewhat flat. The tip very blunt."

In 1781, at the time the Royal Society was moving to new premises in Somerset House, the Society transferred its collection of rarities to the British Museum, then only in its infancy (Lyons, 1944). In 1809 the British Museum disposed of a number of anatomical preparations to the Royal College of Surgeons for the sum of £175 10s. and some of the original Royal Society

FIG. 1.—"Royal Society" spiral tusk. (Odontological Series G. 122.8.)

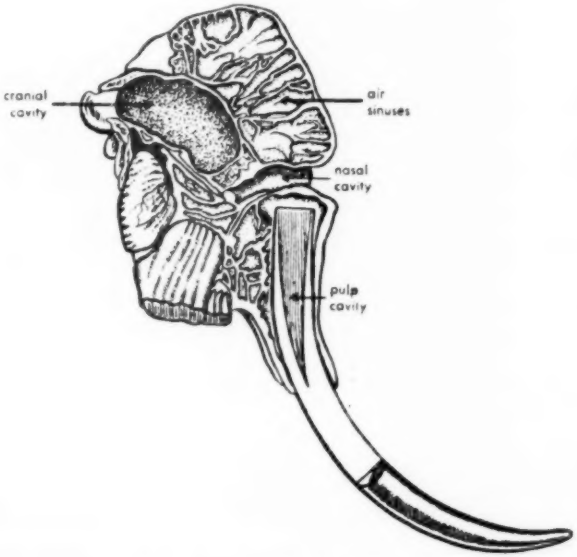

FIG. 2.—Longitudinal section through skull and part of tusk of an Indian elephant. After Owen (Odontography, Pl.146).

specimens were included in the sale (Cope, 1959). Among them was this tusk which thus became part of the Odontological Collection of the Museums of the Royal College of Surgeons.

One of the reasons why elephant ivory and elephant tusks form such a common feature in odontological museums is that they present examples of dental lesions, especially of the dental pulp, on a gigantic scale. The pulp in the tusk shows a quite remarkable ability to recover after severe injury. This recuperative power is attributable at least partly to the enormous size of the pulp and to the fact that, as the tusk is of continuous growth, the pulp has a good blood supply through the wide funnel-shaped base of the root (Fig. 2).

It is not, of course, possible to examine the pulp itself in these museum specimens; nevertheless the probable sequence and nature of events can often be deduced from a study of the shape and structure of the hard parts (Colyer, 1926; Colyer and Miles, 1957).

The tusk seems to be liable to two principal kinds of injury. Firstly, breaking off of the tusk, perhaps during combat or in falls—sometimes no doubt falls into concealed pits made to entrap the animals. When the tusk is broken off the pulp may become exposed because in some cases the living pulp extends into the erupted part of the tusk. There is in our Collection quite a number of examples where, although the exposed part of the pulp must have died and abscesses may have arisen in connexion with the remainder, the pulp has survived to go on forming the tusk which, although deformed, has continued to function. It is very interesting that in many such specimens there is a tendency for longitudinal

FIG. 3A.—Fractured tusk of elephant. The distal extremity (below) presents a worn fractured surface. The greater part of the specimen was formed after the injury and shows the formation of separate elements. (Odontological Series G. 132.4.)

FIG. 3B.—Part of transverse cut surface near the middle of specimen showing disorganisation of growth with formation of separate "columns" of tissue. (Odontological Series G. 132.4.)

splitting or folding of the pulp to occur to form partially, or even entirely, separate small tusks. A typical specimen is shown in Fig. 3A. The distal end of the tusk presents a worn fractured surface and a zone of interrupted growth shows that the greater part of the specimen was formed after the tusk was fractured. The outer surface of this part of the tusk shows longitudinal grooving which becomes progressively deeper towards the proximal end and which at the time of death and removal of the tusk had led to the emergence of at least two entirely separate growing elements. A transverse section (Fig. 3B) from near the middle of the specimen shows that the internal structure is split up into a number of columns. It is of interest that, although the growth of the tusk has been considerably disorganized by the injury, the lozenge pattern characteristic of elephant ivory is clearly discernible.

Another specimen in the Collection, of similar character but in which the interval between the time of the fracture and death of the animal was known to be two years, provided an opportunity to calculate the rate of growth of the tusk (Colyer and Miles, 1957). The calculated growth rate was 3·3 mm per week which corresponds closely with that of the continuously growing incisors of other animals such as the porcupine and rabbit.

The second type of injury to which tusks are liable is from bullets or musket balls or from spears. Early writers were sometimes puzzled to find musket balls within the solid ivory without there being any evidence of a point of entry; they were particularly intrigued if the ball of soft lead showed no sign of flattening from impact with the hard ivory. The presence of a number of such specimens in the Hunterian Collection shows that this is a condition that attracted the attention of John Hunter.

The explanation of a bullet in the substance of the ivory with no obvious point of entry is, of course, that the bullet penetrated into the dental pulp, above the level of the growing end of the tusk, perhaps from a shot from slightly above or aimed at an animal with head lowered to charge.

Fig. 4 shows a specimen in which the musket ball is lying loosely in a cavity. The irregular or "reactionary dentine" formed in response to the injury is known to dealers and workers in ivory as "pith". The outer layer of cementum, which may be very thick, is known as the "bark".

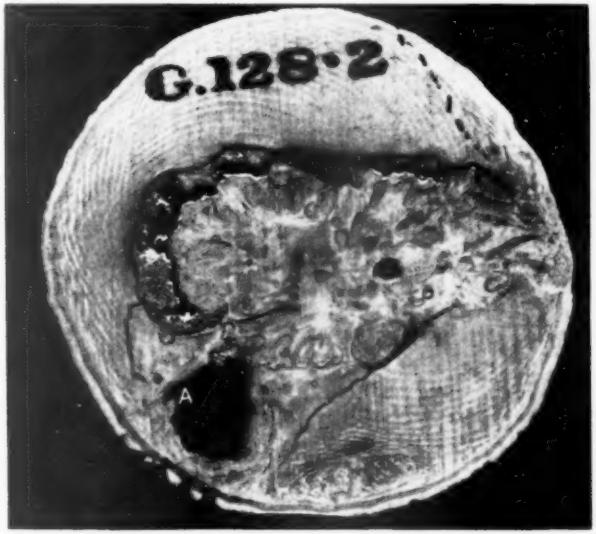

FIG. 4.—Transverse section through a tusk showing repair of the tissue with irregular reactionary dentine (B) following injury by a bullet which lies loosely in a cavity (A).

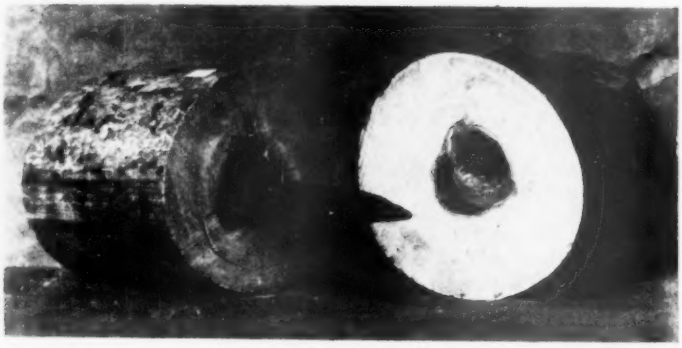

FIG. 5.—Spearhead 7½ in long lying free in the pulp cavity of a tusk. (Odontological series G. 126.1.)

Fig. 5 shows a very remarkable specimen described by Sir John Bland-Sutton (1910). It is a part of a tusk in the pulp cavity of which the iron head of a spear is lying. This must have entered the open developing end of the tusk from above and almost certainly is part of a weighted spear dropped from a tree. The hunter lies in wait on a branch overhanging a waterhole where elephants are likely to come to drink and if an elephant moves into a favourable position the weighted spear is dropped (Fig. 6). A study of Fig. 2 shows how the spear could enter the funnel-shaped end of the tusk.

One of the most attractive and mysterious features of elephant ivory is that a surface cut transverse to the axis of the tusk shows a geometrically regular pattern (Fig. 7). An analysis of the pattern shows that it is composed of two systems of radiating curved lines which begin at the centre of the tusk and sweep outwards in smooth curves to the periphery. One set of lines curves clockwise and the other anti-clockwise. The two systems of lines inter-cross in a regular fashion and divide up the surface into diamond or lozenge-shaped areas which become progressively smaller towards the centre of the tusk. In addition there are the less evident concentric growth lines or lines of Owen.

This lozenge pattern is a constant feature of elephant tusk ivory and is not present in the ivory of the tusk of hippopotamus, walrus, narwhal or wild boar.

Although described by Retzius (1837) and illustrated by Owen (1845) this peculiarity of elephant ivory does not appear to have been satisfactorily explained. A study which will be reported in full elsewhere (Miles and Boyde) suggests that the pattern depends upon the fact that in a longitudinal section cut radially to the

FIG. 6.—A sketch illustrating a method by which African natives attempt to kill elephants. A heavily loaded spear is dropped upon the animal when visiting a drinking pool. Reproduced from Bland-Sutton (1910) by kind permission of the Editor of the *Lancet*.

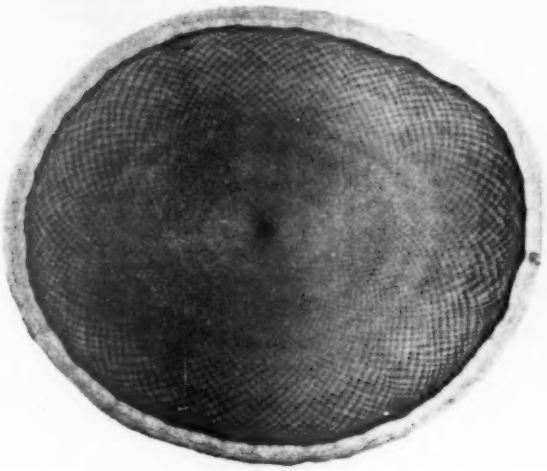

Fig. 7.—Transverse polished surface through the tusk of an African elephant.

centre of the tusk the tubules pass in regular sinuous curves across the thickness of the ivory. Sections in other planes, especially longitudinal ones tangential to the centre of the tusk, show that the tubules are arranged in groups or segmental columns within which the curvatures of tubules are all in the same phase but are in the reverse phase from those of the adjacent columns, that is the troughs of the waves of one column are opposite the crests of the waves in the next (Fig. 8). It seems that ivory appears light or dark according to whether the rays of light strike convexities or concavities of the groups of curved tubules. Were such an arrangement to exist in a tissue which was not circular in section, but where the pulpal surface was quite flat so that the tubules passed across the dentine parallel to one another and were not radiating from curved surfaces, a pattern of rows of alternating light and dark spaces like a chequer board would be produced. As in a chequer board diagonals would be a feature of the design. If the chequer board was made of rubber and was bent round, the diagonals would become curved and the squares distorted in shape; in fact the pattern would basically be the same as that seen in cross-sections of the tusk.

This lozenge pattern enables elephant ivory to be identified in ivory carvings, billiard balls, knife handles, piano keys and all the variety of articles for which ivory is employed. Until the advent of vulcanite about the middle of the last century ivory was, apart from precious metals, the usual material from which dentures were

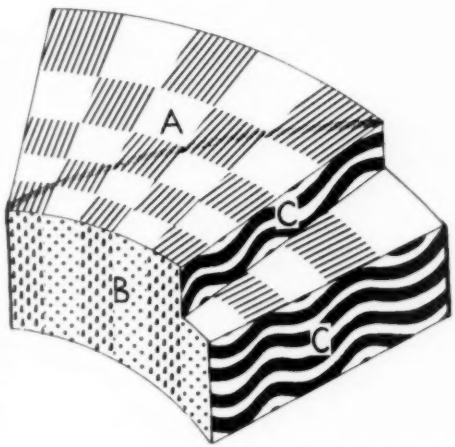

Fig. 8.—Diagrammatic representation of a part of a cross-section of tusk showing the arrangement of tubules in "segmental columns" responsible for the chequered appearance of the surface A. A line drawn through the dark areas emphasises the curved nature of the diagonals. B indicates the pulpal surfaces of the "segmental columns" or groups of tubules. Part of a "column" has been removed to show the undulating curvatures of the tubules in radial sections (C). Troughs of the curves in one "column" are opposite the crests in the adjacent "column".

made. Probably because of its relative softness and less durability in the mouth ivory from the elephant was, however, seldom used for dentures, as is evidenced by the rarity with which the lozenge pattern is found on these articles. Hippopotamus and walrus ivory were the most favoured materials for this purpose, walrus ivory being regarded as a more easily worked and cheaper substitute. According to Spence-Bate (1860) the market prices of hippopotamus and walrus ivory at about that time were respectively 12–30 shillings and 3–8 shillings per pound.

It may well be that the dealings between the ivory-carving dentist of those days and the ivory dealers, who from time to time discovered, no doubt with chagrin, musket balls embedded in the ivory, provided the channel through which so many specimens of that kind found their way into odontological museums.

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Section of Pædiatrics

President—Miss ISABELLA FORSHALL, F.R.C.S.

Meeting
February 26, 1960

DISCUSSION ON HEARING AND SPEECH DEFECTS IN CHILDHOOD [*Summary*][1]

Dr. Mary Sheridan (London):

It is first essential to define the terms language, speech, hearing, listening and interpretation. The latter involves memory, i.e. recognition and recall. The causes of failure or delay in the development of spoken language are not always easy to sort out. The three most frequent causes are: (1) lack of adequate opportunity to learn in the first few years of life, which are critical for the acquisition, not only of speech sounds, but also of verbal symbolism; (2) impaired hearing, particularly over the high frequencies which carry the main characteristic components for consonant sounds and are therefore chiefly responsible for the intelligibility of speech; (3) mental backwardness. Other less frequent, but to the pædiatrician very important, causes are delayed maturation of the central nervous system; lesions involving the cerebral mechanisms for speech as in cerebral palsy; psychogenic disturbance, which includes the schizophrenias of childhood, also the neuroses; motor dysfunctions involving speech organs and finally malformation of the speech organs themselves.

The problems of cerebral dysfunction in relation to disorders of speech and language in childhood are many and serious and need further investigation in terms of pædiatric neurology.

A full account of this contribution will be published in *Archives of Disease in Childhood.*

Mr. Gavin Livingstone (Oxford):

A child with normal hearing learns to imitate sounds and interpret them during the first three years of his life. Most so-called deaf babies have some residual hearing; if this can be trained during those early critical years the child will have his best chance of learning speech.

In order to find these handicapped babies all those whose hearing fits into the following classification must be considered "at risk" or suspect.

Classification of Causes in Perceptive Deafness in Infants

Pre-natal

(1) Hereditary

(2) Diseases of pregnancy { virus infection / toxæmia

(3) Abortifacients

(4) Prematurity

(5) Hazards of labour { anoxia / birth trauma

(6) Congenital anomalies — atresia (middle-ear deafness)

Neo-natal

(1) Kernicterus of Rhesus incompatibility

(2) Kernicterus of prematurity

(3) Acute infections—measles, mumps

Post-natal

Meningitis { meningococcal / pneumococcal / influenzal / tubercular

Toxic

Streptomycin

Unknown

The ætiology of a further group is unknown but accounts for about 30% of all deaf babies

As it is fourteen times more common to find deaf children among the above group of children than among normal children a register of these "at risk" babies should be kept at all large hospitals, preferably by the pædiatric department. To be comprehensive, this list should be fed by the maternity department, the E.N.T. department and general practitioners; health visitors and midwives should report through the Medical Officers of Health.

All "at risk" babies should have their hearing tested frequently until the presence or absence of hearing is confirmed.

A hearing defect must also be suspected in backward children and those who develop speech late.

Children with bilateral congenital atresia should be operated on between 2 and 3 years of age.

It is probably an underestimate that 1 child in 1,000 is born with a serious hearing loss and that 2 in every 1,000 have a loss severe enough to require special education.

The numbers of cases of perceptive deafness

[1]A fuller report of this meeting will appear in the *Cerebral Palsy Bulletin.*

attending the Radcliffe Infirmary, Oxford, during the last three years are:

Under 5 years of age	58
5–15 years of age	50
Bilateral congenital atresia under 10 years of age	10
Total	118

The analysis of the causes in these 118 cases is:

Pre-natal	47%
Neo-natal	14%
Post-natal	6%
Unknown	33%

It is necessary to assess the hearing of these children who have a possible hearing loss. Audiograms cannot be taken with any accuracy till after the fourth year. Play techniques give valuable indications but the child must be seen several times before a verdict can be given on his hearing or mental retardation. Assessment of the very young involves teamwork between pædiatrician, otologist, psychologist and teacher of the deaf. If any doubt arises about a child's hearing he should be given a hearing aid and auditory training, irrespective of the diagnosis.

The problems of training and educating these children vary with each locality, but decisions taken at this early age vitally affect the child's whole future. In Oxford, at present, deaf children are handled in the following manner.

After a preliminary team assessment, the teacher of the deaf attached to the hospital continues to see the child and his mother frequently for further assessment, and to give help and advice. She gives auditory training, with the co-operation of the parents until the child is old enough to attend a nursery school. She continues to teach the child at this school where he can mix with hearing and speaking children. The child can live at home and attend school daily.

From 5–7 years old he can be admitted to a Deaf Unit in a normal hearing school under a teacher of the deaf employed by the local Education Authorities. From 7–10, if he still is unable to join in the normal school stream, he can continue under a second teacher of the deaf. When he moves on to a Junior School the teacher of the deaf continues to watch over his progress.

Much work remains to be done to find the best methods of treating and educating these children, but there is hope that in future they will be able to take their places in the world as useful and integrated citizens.

Mr. Michael Reed (London):

Although a large number of hearing and speech disorders are relatively easy to diagnose and treat, many remain which are extremely difficult to diagnose and to treat. With a greater emphasis on earlier and more accurate diagnosis of hearing defects come greater difficulties in this problem. From a mental age of 3 years there is usually no difficulty in establishing a reasonably accurate assessment of hearing provided there is co-operation on the part of the child, and provided the adult commanding co-operation understands not only the techniques of assessment of hearing, but also the management of children and particularly the management of children with a difficulty in communication.

Below a mental age of 3 years one establishes a good estimate of hearing by distracting sounds and the responses made to them, the child's history and parental observation.

Frequently the child does not respond or behave normally and the cause may be obscure. A complete lack of response to sound may be due to: (1) Severe deafness. (2) Moderate deafness in a very young child. (3) Severe mental retardation. (4) Psychological withdrawal. (5) An aphasic or dysphasic condition (sensory). (6) A physical inability to make the normal responses.

A lack of response to some sounds or a variable response to all sounds may be due to: (1) Partial deafness. (2) Variable deafness. (3) Mental retardation or immaturity. (4) Psychological withdrawal. (5) An aphasic or dysphasic condition. (6) Lack of attention.

A normal response of awareness to sound but delayed or defective speech may be due to: (1) Normal hearing but delayed or defective speech. (2) A high-tone loss of hearing with normal or near normal hearing for low tones. (3) A low-tone loss of hearing with normal or near normal hearing for high tones. (4) An aphasic or dysphasic condition. (5) Developmental delay. (6) Mental retardation.

In groups 2, 3 and 4 one often finds children mistakenly thought to be mentally retarded, particularly if there is a disturbed behaviour pattern. A hearing test should be given to all children suspected of being mentally retarded or who have delayed or defective speech. It is equally wrong to consider an abnormal behaviour pattern to be due to deafness because there is a lack of response to sound.

Hyperactive or withdrawn children present difficult problems in diagnosis because one cannot gain their co-operation. Long-term investi-

gation is necessary with the co-operation of pædiatricians, otologists, neurologists, psychiatrists, psychologists, teachers and parents. It may require a special day or residential centre in which treatment, of a kind, may be started before final diagnosis. The treatment may be merely to establish a relationship between a child and an adult from which may come co-operation for test procedures. Thus the treatment or training may itself be diagnostic. Once co-operation has been established hearing and mental tests may be given. If these results are within normal limits and there has been a normal speech environment, then aphasic or dysphasic conditions have to be suspected, once the maturational level for speech has been passed.

The partially deaf child who is also dysphasic must inevitably wait a long time before this condition can be considered. Only after a period of time in a speech-learning situation can this be diagnosed.

In assessing the mental abilities of such children, although it is obvious that non-verbal tests must be used, one must also be aware that some non-verbal pictorial items may demand full speech comprehension for their full significance to be realized.

Miss W. Galbraith (London):

The Teacher's Angle

There are many problems facing a teacher who deals with children suffering from an impairment of hearing and its inevitable effect on speech. My remarks are restricted to those difficulties which face a teacher working outside the established special school system.

The child's hearing loss will doubtless have been ascertained as a result of teamwork between the otologist, psychologist and educationalist. No rehabilitation can be adequately undertaken without full details of the child's hearing loss, intelligence, social background and medical history.

Particular problems occur at certain ages:

Under 2 years.—We need to solve the problem of building up communication between the child and other people in his environment. The parents and family must be given help in adjusting to the idea of a member of their unit having a disability. In my experience the majority of parents can benefit from instruction to enable them to help their baby to acquire language and a good speech habit. Any residual hearing must be used and at this age not only is the child more able, owing to his maturation, to learn to discriminate, but it is much easier to fit an aid satisfactorily. The parents can be trained to give the child the necessary help. All this is achieved in a superficially casual manner.

2–5 years.—We are faced in addition with those problems usually associated with the toddler age. Many behaviour difficulties at this time are only aggravated by the disability and not caused by it. Here again parents need a great deal of help in dealing with social training as well as in aiding the child to acquire communication skills.

In most cases a period in a normal hearing nursery school will help solve behaviour problems as well as stimulate the child's language and speech development. A Danish colleague of mine has made a comparative study of the development of the speech of both the hearing and the deaf children in her kindergarten. The normal child's language has been reflected in that of the deaf children (Willemoës, 1960). The provision of an aid is essential but proves a more hazardous operation than at an earlier age. Auditory training will be on more formal lines.

5–11 years.—These children will already have received home training, or be late referrals. More individual help will be given by the teacher although the home must still co-operate. Training in language, speech and in the basic school subjects is needed. The suddenly deafened child in this age group requires immediate auditory training, speech conservation and lip reading if he is to maintain his place in school. Teachers in the normal school also must be helped to overcome any difficulties they are meeting, especially in considering where to place the child.

11 years and over.—This group is often the most difficult to help. We are made aware at this age of the great social handicap of deafness. There are the usual adolescent problems, aggravated by the child's objection to being different, which he feels is emphasized by the aid. Extra coaching in school lessons is usually imperative at this stage.

The doubly handicapped child.—Briefly, it is not always possible to regard the deafness as the major disability. We need much more co-operation between all members of the different specialties dealing with children who are also educationally subnormal, blind, physically handicapped or, especially, spastic. The key to the success of all training of acoustically handicapped children, however, lies in the training of the parents.

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Meeting
March 25, 1960

Tongue Swallowing.—A. BONNARD, M.B. (for D. MORRIS, M.R.C.P.).

The autistic, addictive practice of "tongue swallowing", found in two patients in child psychiatric practice (psycho-analytic), is of special interest. Aberrations of lingual activity and posture, both overt and covert, are now recognized to be commonplace by orthodontists and speech therapists and "tongue swallowing," a covert practice, is unlikely to be confined to individuals of abnormal mentality. Since the apparently unrelated bronchial infections present in both the following cases disappeared on cessation of the practice, concurrently with the disclosure of its existence, the condition may have diagnostic and therapeutic significance.

Grateful acknowledgment is made to Dr. Ian Gordon for his bold suggestion that the phenomenon of tongue swallowing could be proven by X-ray. As will be seen from Fig. 1, occlusion of the oro- and naso-pharynx by palatal compression by the tongue explains the mechanism of its puzzling signs and physiological consequences.

Case I.—E. H., a boy aged 11, had had intensive psychoanalytic treatment for one and a half years before the nature of his secret lingual practice was suspected. He had been referred on account of grave character and behaviour disturbances, including wild hypermotility with callous destructiveness and serious attempts to strangle children and animals. A diagnosis of borderline psychosis was made. Treatment was sometimes interrupted because of sharp bouts of bronchitis. The parents also noticed "irregular breathing and breathing noises". During his treatment sessions, the patient was destructive or did acrobatic contortions ("making myself more double-jointed") or else sat silent and withdrawn, with a "glazed" expression suggestive of diminished consciousness. He exhibited rapid or gradual changes of facial colour, varying between normal and a greyish pallor, accompanied (when withdrawn) by a "long-faced appearance" and short periods of apnœa terminated by a gasping sound, to the accompaniment of a wide excursion of the ribs. The puzzling nature of the gasp with absence of the necessary concomitant movement either of the nares or of the apposed lips, finally provided the clue. He was asked "As you are so good at bending tricks with your body, can you do any with your tongue?" He replied with his first expression of real animation and pleasure, "I can swallow it". He was delighted to demonstrate his uncanny expertise whereby the floor of the mouth is emptied and the pharynx is hidden by a curved shining mass, the underside of the overcurled tongue (Fig. 1), which reaches back to the soft palate compressing it against the posterior wall of the pharynx and blocking the respiratory passages. Not only was this discovery the first step towards greater psychic accessibility, but it marked the end of his bronchial infections, the strangling attempts and his "double-jointed" acrobatics. It must be stressed that although the strangling and "double-jointedness" served as the displaced externalizations or re-enactments of the various muscular, sensory and physiological facets of the act of "tongue swallowing", *none of the foregoing had previously attained conscious awareness*. While it is impossible to enlarge on the psycho-dynamics of imperception (in consciousness) of volitional acts, in the present case this state was secondarily reinforced through a special factor, that of self-induced anoxia. At the present time the patient (I.Q. 118), now aged 14 years, is a handsome model of good behaviour in a boarding school. Neither his psychiatric disturbance, apparent since toddlerhood, nor the nature of his past treatment has been divulged to the school. However, the psychiatric prognosis must remain a guarded one.

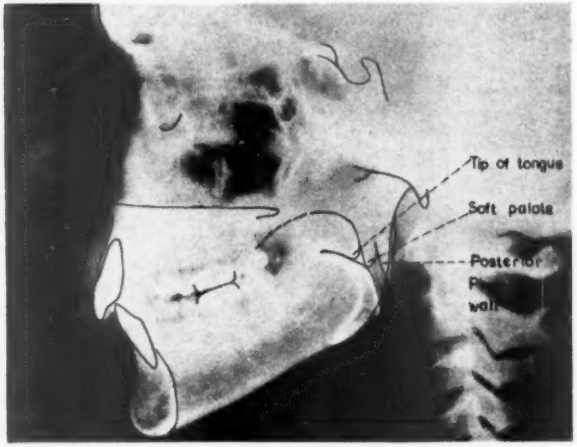

FIG. 1.—"Tongue-swallowing" by overcurling, showing total occlusion of the oro- and naso-pharynx caused by compression of the soft palate by the tongue. (Photograph by courtesy of Professor C. F. Ballard.)

Case II.—C. P., a girl aged 10, was referred to the East London Child Guidance Clinic by the headmistress of her open-air school on

account of general apathy and certain oddities of conduct and facial expression. A long history of "chest troubles", aberrations of breathing, and a debilitated appearance accounted for her acceptance there. At I.Q. test, her intelligence was average. She had once been admitted as an emergency to hospital for sudden obstructive breathing and cyanosis, but no cause was found. When she was 4 years old she witnessed a small brother's death from sudden obstructed breathing; autopsy revealed acute necrosis in a thymoma. After several interviews (diagnosis—borderline psychosis) it was noted, due to the recent discovery with the first patient, that when her colour fluctuated she, too, seemed to become more "long-faced" and "glazed" in expression. Direct questioning led to a blank denial of tongue swallowing, but with more tactful re-wording in terms of a possible accomplishment, she conceded she "would try it just for you". A strikingly instructive X-ray picture of lingual-palatal occlusion of the upper and lower air passages by "tongue-swallowing" was obtained. She has since had intensive psycho-analytic treatment at the Clinic by Mrs. L. Neurath which has been most encouraging. Her mental and physical state greatly improved and after about two years she insisted on a transfer to the local school in order to pursue an active social life with her "ordinary" peers. It remains uncertain whether the traumatic episode of her brother's death, together with its family after-discussions, plays any part in her lingual- as distinct from her psycho-pathology.

The "long-facedness" and the accompanying dropping of the dewlap are all that can be seen externally in "tongue-swallowing". The muscular efforts and heightened oral space required for this feat explain an appearance which, when accompanied by breathing or colour changes, may prove pathognomonic. "Tongue swallowing" probably belongs to those autistic devices to which some infants resort in order to banish unwelcome situations. Aberrant lingual activities are also a reminder of the important role of the tongue's many different capacities and functions in normal development. In modern terminology, the tongue might well be described as the "forum of innate releasing mechanisms".

ADDENDUM (8.8.60).—A third case of "tongue swallowing" has recently been detected in a hysterical, 12-year old boy. Among his hypochondriacal complaints he admitted to a fear of a stiff sensation in his neck; he also suffered from sudden blockages of breathing. He was eager to demonstrate his expertise with his tongue, and was relieved to learn that this was the cause of his symptoms.

Congenital Absence of the Corpus Callosum.—JOHN LORBER, M.D., M.R.C.P.

A. B., the first baby of healthy parents, was delivered by forceps after a normal pregnancy of 42 weeks on September 13, 1959. The baby was well, weighing 8 lb 11 oz, but her head was unusually large with a circumference of 15 in. (normal range 13¼–14½ in.). Early development was uneventful. She started to smile, recognize her parents and follow at 6 weeks of age. She had no fits or any other manifestations of ill-health. Nevertheless, by 7 weeks her head circumference had increased to 17½ in. (normal range 14½–15¾ in.). The sutures were widely separated; the anterior fontanelle was very widely open, but was under normal tension. Hypertelorism; no other abnormal physical signs. Fundi normal. Congenital hydrocephalus was suspected, though the normal tension of the fontanelle was against this diagnosis.

A ventriculogram was performed at 8 weeks of age. The needle passed into the right lateral ventricle, which was found in the usual position at a normal depth of 45 mm from the surface. C.S.F.: pressure 120 mm of water; composition normal. The left ventricle was reached at exactly the same position, 45 mm from the surface. The ventriculogram showed an unusually complete and typical appearance of agenesis of the corpus callosum. The anterior horns and the body of the lateral ventricles were of normal size and symmetrical, but widely separated from each other. On the postero-anterior view they presented concave medial and convex lateral borders. The posterior horns of the lateral ventricles were moderately dilated. Between the two lateral ventricles very wide foramina of Monro were clearly visible, joining a very large mid-line cavity (Fig. 1) which was presumably an upward extension of the third ventricle. The air rose to the surface of the skull in the mid-line, and then spread forward and backward so that it occupied the midsagittal plane from the frontal to the occipital region.

Subsequent progress has been uneventful and she had no illnesses and no fits. EEG was normal. At the age of 6 months physical development was good; head circumference 19½ in. (average 17½ in.). The anterior fontanelle was widely open, and extended well forward into the forehead, but it was not under abnormal tension. The suture lines were normal, and the posterior fontanelle was closed. She had distinct hypertelorism, the distance between the inner canthi of her eyes being 35 mm. No abnormal neurological signs. Her mental development was only very slightly below normal except for head control which was considerably retarded, possibly because of the weight of her head.

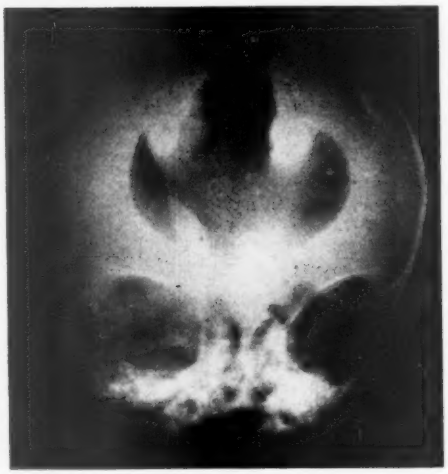

FIG. 1.

Comment.—Agenesis of the corpus callosum is essentially a radiological diagnosis during life. The criteria for this diagnosis, established by Davidoff and Dyke and by Penfield and Hyndman in 1934, were all present in this patient. Agenesis of the corpus callosum may be the sole apparent manifestation of anomaly of the central nervous system or may be associated with a variety of other conditions, including hydrocephalus. The association with hypertelorism has been noted in one case by Derbyshire and Evans (1941), and in two others by Carpenter (1954). The incidence of agenesis of the corpus callosum is not known. Before radiological diagnosis was possible Baker and Graves (1933) found 82 cases in the literature and added another to these. Carpenter and Druckmiller (1953) traced 47 cases diagnosed by encephalography, in 7 of which the diagnosis was confirmed by necropsy. Carpenter (1954) studied 18 cases who were diagnosed during life at the Neurological Institute and Babies Hospital in New York City between 1933 and 1953. Nearly half of these were hydrocephalic. About two-thirds of his patients had major epileptic seizures some time in their life and 4 out of 5 were retarded. It is, however, not possible to ascribe any clinical pattern which is directly due to agenesis of the corpus callosum alone, as most patients have other central nervous system defects. It is striking that the absence of such a major structure should not result in specific neurological signs or lead to any constant mental changes. 15 of 45 cases analysed from the reports of others by Carpenter and Druckmiller (1953) and 8 of Carpenter's (1954) 18 cases were neurologically normal individuals. Division of the corpus callosum in experimental animals only results in the most trivial departures from normal (Wood Jones and Porteus, 1929).

Acknowledgment.—I am happy to acknowledge the help given by Dr. R. R. Grainger in the interpretation of the radiographs.

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Myotonia Congenita with "Delayed Myotonia."—VICTOR DUBOWITZ. M.B., D.C.H. (for DAVID LAWSON, M.D., M.R.C.P.).

C. B., female, aged 9.

History.—The pregnancy, labour, neonatal period and milestones were normal. She started walking at 12 months. About that time her parents noticed that she was stiff after getting up from a sitting position. Stiffness also occurred whenever she started walking, running or climbing stairs, but with further activity she seemed to "loosen up" and her movements became quite normal. These episodes of stiffness have persisted, with slight deterioration. Changes in temperature have not influenced the symptoms. Although the patient experiences no handicap in her everyday activities, she herself has been aware of marked generalized stiffness on waking in the morning, and when competing in races at school finds herself "glued to the starting line."

Family history.—Negative. Two sibs (aged 4 and 2), the parents and the maternal grandparents showed no evidence of myotonia on examination.

On examination.—Generalized (true) muscular hypertrophy (Fig. 1). No weakness of any muscle groups. Marked stiffness of gait after sitting for even a short period. This gradually disappeared with continued activity. Slight (voluntary) myotonia present in finger flexors (inconstant). Percussion myotonia elicited in the tongue (Fig. 2) and on occasion in the thenar muscles, flexor pollicis longus and flexor digitorum sublimis. Tendon reflexes normal. ECG normal. EMG characteristic of myotonia.

Because of the mildness of her myotonia and the short relaxation time of her grip (usually less than 1 second) the following test was used. After lying at complete rest in a supine position for

←FIG. 1.—Generalized muscular hypertrophy.

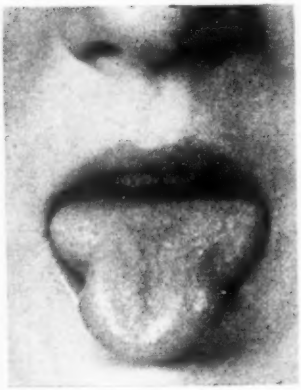

FIG. 2.—Percussion myotonia of the tongue after mechanical stimulation.

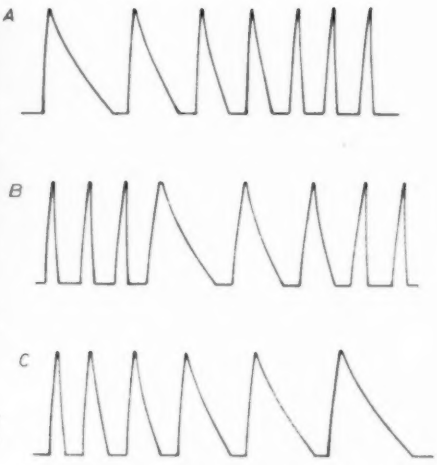

FIG. 3.—Diagrammatic representation of successive contractions in A, myotonia; B, "delayed" myotonia; C, "paradoxical" myotonia.

thirty minutes she was asked to sit up and lie down repetitively. The number of times she had to repeat the movement before she was able to do it without any difficulty was taken as an index of her myotonia. Instead of the expected maximal myotonia with the first movement, she was able to sit up from the supine quite normally two or three times. Typical myotonia of the extensor muscles of the spine then became apparent and she had extreme difficulty in sitting up. This gradually subsided with successive movements until she was quite normal after repeating it seven to ten times (Fig. 3).

Discussion.—In myotonia the delayed relaxation of muscle after a contraction (active or voluntary myotonia) is characteristically maximal with the first contraction and declines progressively with successive contractions. The phenomenon of a few normal movements prior to the onset of typical myotonia in this patient is of particular interest. On theoretical grounds it suggests the possibility of an enzymic defect by which the muscle is only capable of relaxing normally for one, two or three contractions. The presence of hypertrophy of the muscle fibres in myotonia congenita might be due to the accumulation of one of the intermediate products of metabolism. Percussion (mechanical) myotonia is due to the increased irritability of the muscle to mechanical stimulation and the associated delay in relaxation. It is of interest that the tongue, in contrast to the skeletal muscle, is not hypertrophied.

The phenomenon described in this patient is not the same as the so-called paradoxical myotonia (Stattmüller, 1923; Marshall, 1952) in which the mytonia progressively increases with successive contractions (Fig. 3). It also differs from the increase in myotonia associated with increased force of contraction (Ravin, 1939), but bears some resemblance to the increased myotonia with the second contraction recorded by Ravin (1940). A suitable description in our case would be "delayed myotonia".

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Melkersson's Syndrome. — DENNIS BARLEY, F.R.C.S. (for HUGH JOLLY, M.D., M.R.C.P.).

D. G., boy aged 9.

History.—First seen 15.9.59. During the previous four weeks he had had three attacks in which the area of scalp around his left ear had become swollen, at times causing outward displacement of the pinna. The swelling, which lasted up to five days, sometimes involved the left side of the face and the back of the head. It was painful and the overlying skin was tight and shiny but not red.

He was seen during the third attack, though a

FIG. 1.

little after its height. He was not ill but œdema of the scalp was present immediately above the left pinna, the upper part of which was displaced outwards. Five days later he developed a left facial weakness and was admitted to hospital on 23.9.59.

On admission.—Not ill, but with a complete left lower motor neuron facial paralysis and a pink left ear drum. Despite physiotherapy the left facial weakness did not improve and electrical tests on 6.11.59 showed complete reaction of degeneration. 31.12.59: Decompression of the left facial nerve was performed. The whole of the descending portion of the nerve was exposed and its sheath incised; the upper part of the nerve was œdematous and the lower part atrophic. No infection of the middle ear or mastoid was evident. Early signs of recovery in the nerve are now appearing in that there is a greater ability to close the left eye and minimal movement of the angle of the mouth.

This case is an example of Melkersson's syndrome which comprises the following triad: (1) Peripheral facial palsy, which may be familial, is often bilateral and may show a tendency to relapse. (2) Angioneurotic facial œdema, especially of the lips. (3) Lingua plicata. In this case, fissuring of the tongue is limited to lateral serration.

"Dysregulation of the vasa nervoram" (Kettel, 1959) as a result of autonomic stimulation is responsible for this type of facial nerve palsy. The blood supply of the facial nerve has never satisfactorily been demonstrated owing to the difficulties of intratemporal bone dissection. Blunt (1956), by injection techniques, was able to show an arterial anastomosis between branches of the external carotid artery and the middle meningeal and anterior inferior cerebellar arteries. Using a development of a method first suggested by Dr. Oliver Gray (1948), temporal bone dissections in Perspex have provided a new means of following the courses of all soft tissue structures within this bone.

Fig. 1 shows the horizontal and vertical parts of the facial nerve within a left temporal bone and its relations with the semicircular canals, the structures of the medial wall of the middle ear cavity, the dura mater and the lateral sinus. The vertical part of the nerve between the lateral semicircular canal and the stylomastoid foramen is that part affected in Melkersson's syndrome and Bell's palsy, and is the segment freed from the enveloping fallopian canal by the decompression operation.

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(*Meeting to be continued*)

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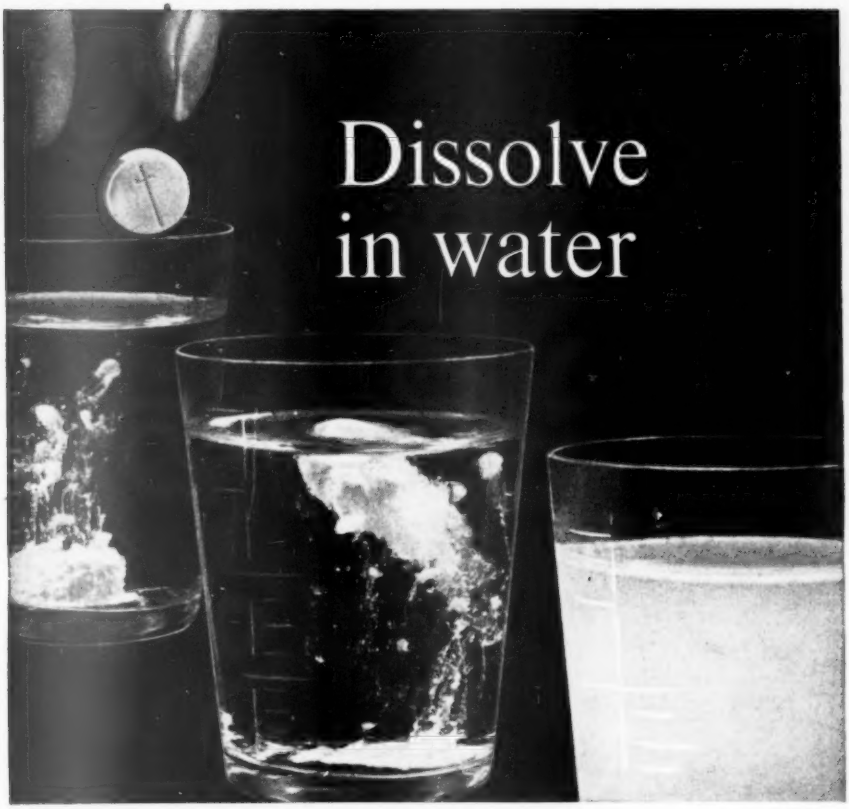

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Section of Medicine

President—E. R. CULLINAN, M.D.

Meeting
March 22, 1960

DISEASES ASSOCIATED WITH ABNORMAL PLASMA PROTEINS

Professor J. Waldenström (Malmö, Sweden):

Clinical Aspects

Recently work has been done in collaboration with C.-B. Laurell and S. Winblad on conditions which are characterized by a narrow-banded hypergammaglobulinæmia. Fig. 1 shows the difference between this type of gamma globulin increase, called the M-type by Riva (M for myeloma or macroglobulinæmia), and the broad-banded type. The upper of the two strips marked "sisters" represents the narrow, and the lower represents the broad-banded type. "Cirrhosis + ca" at the bottom shows both narrow and broad-banded gamma globulin. The narrow band will be discussed later. The broad band is chiefly found in conditions where an immune response is supposed to be an important factor, and is found in certain virus diseases such as lymphogranuloma venereum, (*see* Waldenström *et al.*, 1951), the collagen diseases, liver cirrhosis, purpura hyperglobulinæmia and many of the now so-called immunopathies. Both types are found in patients in whom the diagnosis of essential hyperglobulinæmia (Waldenström, 1952) is the only possible one even after a careful post-mortem. These findings corroborate the original idea that some patients suffer from a disease in which the fundamental pathological process must be regarded as an "essential" disturbance of gamma globulin synthesis.

In Fig. 1 are paper electrophoresis strips of serum from two sisters. One has clinical signs of typical systemic lupus erythematosus (S.L.E.) with a broad-banded gamma globulin and a rich collection of positive serological reactions. The other has had very variable clinical symptoms and a high E.S.R. for many years. Since 1958 she has had a narrow band in her gamma globulin. This has increased over the years from 2·1 to 2·8 g%. Comprehensive serological examination gave negative results for all reactions (*see below*). She has no skeletal signs of myeloma but her plasma cell count in the bone marrow has increased progressively. It seems possible that she is now developing a myeloma and that her previous condition, with only a narrow-banded gamma fraction, represented a "premyeloma". The occurrence of these fundamentally different protein changes in two sisters may be entirely fortuitous but could point to some influence of genetic factors, and Leonhardt has studied the genetic aspect in families with hyperglobulinæmia and S.L.E. occurring together.

The next two strips marked E. S. and G. M. represent sera from two patients who have been followed for a considerable time. E. S. has had an unexplained increased E.S.R. since 1947. In 1950 electrophoresis and ultracentrifugation indicated a high-molecular gamma globulin. She is still under observation and in spite of her advanced age (89) she enjoys unusually good health with no symptoms of systemic disease, but with an increasing anæmia. The same is true of patient G. M., who is now 78.

The clinical picture of typical macroglobulinæmia with the usually rapid development of serum protein disturbance in patients with enlargement of lymph glands and/or spleen and lymphocyte proliferation in the bone marrow is in contrast to patients like E. S. and G. M., who have no abnormality other than a narrow macro-

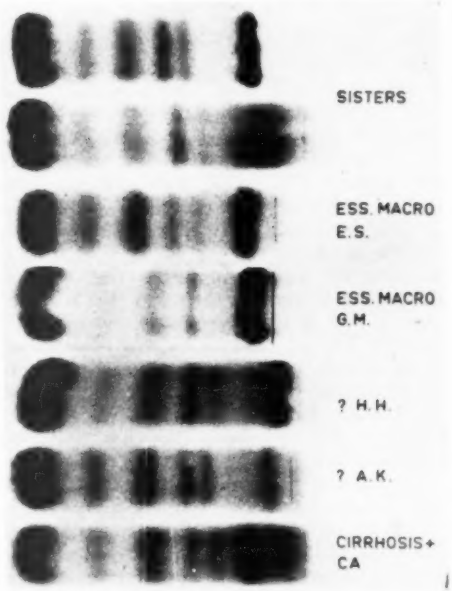

FIG. 1.

globulin band and may remain in good health for years. A long history of anæmia and unexplained high E.S.R. may occur before the comparatively rapid development of serious anæmia and a fatal outcome.

The two electrophoresis strips marked H. H. and A. K. (Fig. 1) are from patients in whom the only pathological finding was an unexplained high sedimentation rate. In these patients the pathological globulin had a normal sedimentation constant (7 Svedberg units) and no unusually high carbohydrate content. Symptoms of myeloma are not present. The last strip, from the serum of a patient with cirrhosis of the liver (probably alcoholic), also had a narrow band. This patient died from a prostatic carcinoma but signs of bone marrow metastases were not found radiologically or at post-mortem. No myeloma was found.

The problem of narrow bands and carcinoma was first discussed by Wuhrmann (1947), who noted that a number of patients with macroglobulinæmia also suffered from carcinoma. Azar *et al.* (1957) have also described a number of patients with carcinoma and M-type globulins, but have not done any ultracentrifugal investigations. We have a number of patients with carcinomas in different organs, who have M-type globulins both of the macro- and the ordinary type. It is of course much too early to suggest that these globulins should be regarded as antibodies against the tumour, but this is an interesting possibility.

As myeloma and macroglobulinæmia are known to occur in elderly patients, we have divided our cases into age groups. These represent all cases diagnosed (and probably nearly all cases occurring) in a ten-year period among the 200,000 inhabitants of Malmö, and are probably the only representative, non-selected group of myeloma cases published so far. The age at clinical diagnosis is seen in Fig. 2A. Fig. 2B gives the age for all cases of macroglobulinæmia known in 1957 (Waldenström, 1958). Fig. 2C presents the ages in the group of essential M-type hypergammaglobulinæmia. This group is too small to allow any conclusions to be drawn, although 70–80 years represents the biggest age group among the myelomas and 60–70 among the essential cases. This does not contradict the hypothesis that they could be premyelomas.

It is possible that some factor that increases with the age of the person causes a change in the formation of one (or possibly some related) member(s) of the gamma globulin group. This change is always irreversible (we have never seen disappearance of an M-type globulin). Burnet (1959) speaks about a mutation occurring in

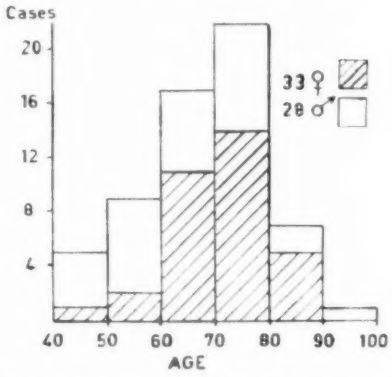

FIG. 2A.—Age distribution of all myeloma cases in Malmö, 1950–59.

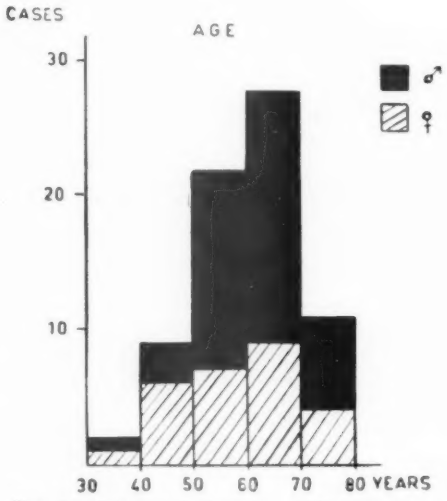

FIG. 2B.—Macroglobulinæmia. All known cases.

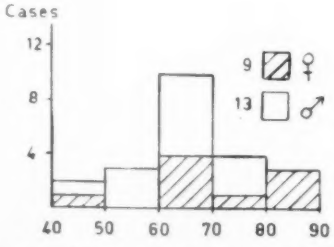

FIG. 2C.—Other cases with M-type globulins (essential).

myeloma. In 1944 I compared the process to the changes seen in a virus-infected plant where the virus forms an abnormal template for protein synthesis (Waldenström, 1944). Other parallels could also be drawn. Many authors now believe that "cancer" occurs after several successive changes have occurred in a cell. The final step would then be the unlimited malignant growth of the plasma cell (myeloma) or the lymphocyte (macroglobulinæmia). Similar developments are often seen in lymphatic leukæmia, also a disease of elderly people.

If this reasoning is correct an aged population should contain many more persons with "essential" M-type gammaglobulinæmia than myeloma, and investigations of this aspect are still in progress.

One remark regarding the predominant serum protein in myeloma seems appropriate. Among the published cases with "macroglobulin" increases some are said to have been found in myeloma patients with typical bone destructions. It is probable that the authors use the term macroglobulin for molecular sizes much lower than the original definition of a macroglobulin given by Waldenström and Pedersen (1949). The sedimentation constant of macroglobulins was given as 19–20 S, whereas we had recorded a number of typical myeloma globulins with sedimentation constants of about 11 S.

The fact that the globulin band is broad in the "immunopathies" and narrow in the M-type might of course indicate that a large number of different individual proteins are present in the first type, whereas we have been struck by the fact that the M-globulin in one individual always remains the same. Together with S. Winblad we have collected a large number of sera with M-type globulins and with broad bands for serological tests. The M-globulins often show anticomplementary activity and sometimes act as antithrombins, but otherwise the "serology" is negative. This is in sharp contrast to the broad-banded gamma globulins. Many sera gave a number of positive reactions to routine tests, i.e. Wassermann, &c., anticomplementary effect, sheep cell or acryl plast agglutinins, antistreptolysin, antistaphylolysin, rarely cold agglutinins, heterophilic antibodies, &c. The tendency to form all sorts of antibodies must be very great in these patients. Also, circulating anticoagulants were not rare among these patients (Waldenström and Winblad, in press).

I am convinced that intermediate cases exist and that we should never be too schematic in our conceptions of disease. The following drawing (Fig. 3) illustrates this. The five circles n Fig. 3 represent diseases where M-type globulins of the γ family are seen. Myeloid leukæmia usually does not lead to this, but we have seen one patient, whose history will be published in detail, where the serum contained a cryoglobulin which precipitated as a gel and was of high-molecular weight (19–20 S) and rich in carbohydrates. It is seen that the two circles, myeloma and macroglobulinæmia, show overlapping with all their neighbours. A has been described as a rare condition by Mackay (1956) and by Wanner and Siebenmann (1957), but we have not seen such a case. B is not rare; these patients are regarded clinically as having macroglobulinæmia, whereas the pathologist classifies the anatomical findings as lymphosarcoma. C represents one particular patient studied by me who had both diseases clinically and at post-mortem was found also to have reticulosarcoma! He is therefore C + G. D has already been discussed; there are a few patients with the typical clinical picture of the disease who have also had small bone destructions resembling early myeloma. E has been described by several authors (Lennert, 1955; Lelbach, 1957; Zollinger, 1958). G has been seen by us also in a case other than that described as C (above). H is probably in itself nothing but a construction but it should be remembered that bone destruction somewhat resembling multiple myeloma may occur in myeloid leukæmia. I is not altogether rare in myeloblastic acute leukæmia, and we have seen one such case.

The explanation of all this overlapping is of course the fact that there is one common stem cell ("reticulum") for many of the pathological tissues involved in these diseases.

Much discussion has resulted from our use of one specific product of cell metabolism, i.e. macroglobulin, for the classification of one of

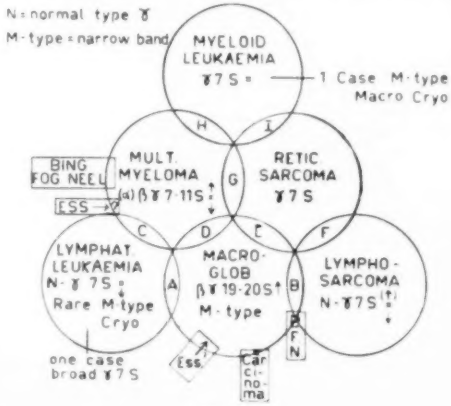

FIG. 3.

these diseases. It seems to me that all biological characteristics of a cell—morphology of cell and tissue as well as metabolic functions such as protein synthesis of different types of proteins, osteolytic capacity, tendency for the cells to remain sessile or to go into the blood stream (leukæmia)—are all important for the characterization of a disease. For the physician the prognosis is of paramount importance. The disease characterized by the appearance of macroglobulins in large quantities in the serum has a decidedly better prognosis than that of multiple myeloma, where severe pains, bone destruction, anæmia and cachexia usually develop quickly.

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Dr. A. S. McFarlane (London):

Biophysical Background

Within twenty-four hours of withdrawing a substantial amount of blood from man or dog the serum electrophoresis pattern shows a marked increase in the proportion of α_2 and a smaller increase in beta globulins, and these changes must be regarded as expressing a physiological adaptation. Almost identical patterns are seen in the sera of nephrotic patients, presumably secondary to loss of plasma proteins in the urine. In cirrhosis fairly normal proportions of albumin, alpha and beta globulins are usually seen but prominent diffuse gamma globulin bands are present. The basis of these patterns may also be essentially an adaptation—this time to a deficiency in liver-produced proteins—even where it is established that the mass of circulating gamma is increased and not just its relative concentration. The physiological situation is a complicated one in which a minimum colloid osmotic pressure must be maintained in the plasma and in which the levels of exchangeable plasma proteins in the extravascular fluid also play a part. The reverse situation in which excess of a protein in the plasma, or even of dextran, produces a compensatory diminution in the others can be realized experimentally.

It is wise to examine carefully the criteria by which protein normality is to be judged. Frequently a narrow peak or spike is seen superimposed on normally diffuse electrophoretic bands. Are these abnormal proteins or are they increases in components normally present in small amounts? This problem is a particularly difficult one in the gamma region where it is of importance in relation to theories of antibody synthesis. However, let us look at the alpha region. Mucopolysaccharides appear in human plasma and urine in substantial amounts in a variety of unrelated conditions—carcinoma, acute pneumonias, active rheumatoid arthritis. After precipitating almost all the plasma proteins at pH 3·7 with perchloric acid a substantial proportion of these substances appears in the filtrate combined with about an equal weight of protein. This complex has a carbohydrate composition which is qualitatively typical of that found in association with normal plasma proteins. Mannose, galactose, glucosamine, fucose, and sialic acid are all present in fairly constant proportions. The acid mucoprotein migrates mainly as an α_1 globulin on paper and as a well-defined prealbumin by free electrophoresis.

The nature of the linkage between the carbohydrate complex and the protein is not precisely known but could be polar—similar to that binding sulphonated dyes to proteins. When Evans blue and labelled serum albumin are mixed and injected the dye can be shown to exchange between labelled and unlabelled molecules without becoming detectably free in the plasma (McFarlane, 1958). Obviously acidic mucopolysaccharides delivered into the plasma could become protein bound like Evans blue, facilitating their transport and yet remaining exchangeable for metabolic purposes. This is a hypothetical situation in the case of mucoproteins but has been shown to be true for beta-lipoproteins (Giltin *et al.*, 1958). Large beta globulin increases observed in free electrophoresis patterns often disappear completely on extracting the lipids. These are clearly lipid rather than protein abnormalities and similarly we may ask whether some of the other globulin abnormalities are not due primarily to disturbances of carbohydrate metabolism. As a tentative generalization I suggest that if the prosthetic group of a conjugated protein is known to be exchangeable in the plasma we are probably not concerned with a protein abnormality. Isotopic methods are now available to help in deciding about exchangeability.

Macroglobulins, as first suggested by di Guglielmo and Salvini (1954) and now shown by Laurell *et al.* (1957), uniformly have exceptionally high carbohydrate contents—10% or more. Although this carbohydrate is believed to be firmly attached to the protein the macromolecule could conceivably be put together intracellularly

by a process of linking normal gamma-globulin molecules by means of carbohydrate bridges, so that the essential abnormality might still be one of carbohydrate metabolism. In support of this Deutsch and Morton (1957) have succeeded in breaking down the molecule under remarkably mild conditions—treatment with mercaptoethanol at pH 7·2—into molecules the size of gamma globulin, and we and others have had no difficulty in confirming his observations.

Clearly the onus should be on the protein chemist to demonstrate an abnormality in these globulins, but this may not be easy. Two proteins of very different solubilities and electrophoretic mobilities such as normal and sickle-cell hæmoglobins differ only in a single amino-acid residue out of some 300—which is well below the resolution of most methods of estimating amino-acid composition. Also proteins having few, if any, significant differences in elementary composition may behave differently because of different sequential arrangements of their amino-acid residues. Sometimes amino-acid composition is decisive, however; for example, the consistent dearth of methionine in Bence Jones proteins distinguishes them as a group from plasma proteins and leaves little doubt about their abnormality.

Usually differences are evident in myeloma globulins, e.g. in the number of polypeptide chains in the molecule, in the nature of N-terminal end-groups, in solubility, precipitability and antigenicity, and only rarely do we come across two that are identical. Nevertheless the protean range of properties which they manifest as a group appears to be no wider than that shown by chromatographic or salt fractions of normal human gamma globulin. This observation taken in conjunction with the much narrower range of properties exhibited by these proteins individually encourages the view, now widely supported, that all myeloma and macroglobulins are already present to some extent in normal plasma.

It is difficult to devise a decisive test by which this can be confirmed or refuted. Putnam (1958) in particular is against it on the grounds that some myeloma globulins have terminal amino-acid residues, viz. alanine, leucine, and valine, which are not found in normal human gamma globulin. As so often happens, difference of opinion centres on the accuracy of a technique—this time of end-group analysis. The argument is not merely academic. If narrow-band abnormal globulins are present as trace constituents of normal plasma the situation is quite different from that of the abnormal hæmoglobins and it should not be too readily assumed that these globulins arise, like the abnormal hæmoglobins, by specific gene mutations.

The so-called "broad-band" hyperglobulinæmias require a different explanation and indeed have equally perplexing ætiologies, including as they do virus and protozoal infections and collagenous degenerations. When labelled amino acids are injected, freshly synthesized highly labelled plasma proteins are delivered promptly into the plasma. For practical purposes the delivery is complete in three to four hours, and this applies to many antibody globulins and to myeloma- and macroglobulins. However, when antibody production takes place mainly in peripheral lymphoid sites, delivery of labelled molecules into the plasma is spread over some days. Gregoire and others (1958) have induced this kind of production by injecting antigens into loose granulomata in the skin of the rabbit. However, the granulomata themselves—caused by non-antigenic irritants—are also associated with elevated plasma gamma globulins containing no recognizable antibodies to any of the irritants used. It seems that these gamma globulins originate in the granulomata because their labelled forms also take some days to arrive in the plasma—being quite different in this respect from normal gamma globulins. This suggests that a variety of non-antigenic irritants—most of them in colloidal or particulate forms—can stimulate the production of a broad spectrum of gamma globulins which pass into the plasma only slowly. These cannot be normal trace constituents of the plasma in the way that narrow-band pathological globulins can be. Could they be waste products originating in engorged phagocytes? If so, they should disappear promptly with removal of the irritant and this is known to happen clinically. They could be essentially waste products whereas the occurrence of narrow-band globulins appears to be best explained by normal protein secretion of single-cell types which have proliferated.

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Dr. G. Discombe (London):

Pathological Physiology

The problems of serum protein changes in disease have recently been reviewed (Discombe, 1959). The differentiation between ordinary myeloma globulins, which sediment slowly because of their low molecular weight, and the macroglobulins of ten to twenty times this molecular weight is becoming important because myeloma and macroglobulinæmia appear to be related to distinct disorders.

In myeloma there is an unrestrained hyperplasia of plasma cells which are the normal precursors of antibodies, whereas macroglobulins seem to be produced by lymphocytes or lymphocyte-like cells, and are involved in some agglutination reactions such as the Rose-Waaler test.

The physical method of identifying macroglobulins using the ultracentrifuge is very laborious. Several methods in which estimates of the rate of diffusion of protein are attempted have been tried to replace this. Electrophoresis on cellulose acetate membranes (Kohn, 1957) gives useful electrophoretograms and if the strip is cut longitudinally in two, one half stained and the other half eluted in buffer for thirty to forty-five minutes, dried, stained, and compared with the original, any gross excess of macroglobulin remains in this strip, whereas ordinary serum proteins and myeloma proteins are eluted. This is a convenient presumptive method to detect macroglobulins (Kohn, 1959). Svartz (1957) and Franklin *et al.* (1957) have shown that the Rose-Waaler test is mediated through a macroglobulin which is a cryoglobulin, and that the test might prove a useful screening test for macroglobulins. In 4 cases a slow-running macrogamma globulin gave titres between 1,000 and 5,000, and a fifth, in which the macroglobulin ran near the beta band, gave a titre of 1,000,000. Using isolated macroglobulins a 1% solution gave a titre of 50,000. This small series suggests that not only electrophoresis-diffusion but also the Rose-Waaler and perhaps other tests might be used as screening tests. Since plasma cells and lymphocytes are descended from the same primitive multipotent reticuloendothelial cells, it seems possible that whether the response leads to the production of plasma cells or of lymphocytes may depend on the nature of the stimulus or on the peculiarities of the patient's body. We know that the "immediate" allergic reaction depends on gamma globulins and is accompanied by œdema, whereas there is a delayed reaction in, for example, contact dermatitis which appears to be mediated through some different mechanism.

Chase (1958) has pointed out that "our experience leads us to emphasize the separateness of the mechanisms underlying delayed type hypersensitivity and the production of circulating gamma globulin antibody. . . . Both aspects of hypersensitivity appear to arise from a basic stimulation of the immunological apparatus, and a particular role played by white cells can be ascribed to each aspect. The separation between these makes it appear unlikely that induction of delayed-type contact dermatitis in guinea-pigs depends on an initial production of antibodies".

In fact, it is now well known that lymphocytes are responsible for delayed reactions (Lawrence, 1956).

All this information, together with Pulvertaft's observations (1959) on the behaviour of surviving lymphocytes could be explained by a single, though rather complex, hypothesis that macroglobulins: (1) Are the chemical messengers involved in the development of "delayed" immunity. (2) Are elaborated by lymphocytes. (3) Because of their high molecular weight and low diffusibility are transferred from lymphocytes to recipient cell by direct contact: any escape to the body fluid is accidental or incidental.

The clonal selection theory of Burnet (1959) suggests that plasma cells and lymphocytes can undergo mutations which may produce increased reproduction rates and slowly crowd out normal cells of the same series. There can also be mutations which would modify the synthesis which is habitually accomplished by the selected clone. Clinical observation suggests that in macroglobulinæmia the reproduction rate is usually only slightly increased, but there may also be some change in the cell surface leading to more ready disintegration, whereas in myeloma the reproduction rate is more considerably increased. Lymphosarcoma and lymphatic leukæmia as a rule are not accompanied by excess macroglobulin and this suggests either a more extreme metabolic mutation, or that the "lymphocyte" may be several different "cells" which we have not yet learnt to distinguish.

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BOOK REVIEWS

Progress in the Biological Sciences in Relation to Dermatology: a Symposium. Edited by Arthur Rook, M.D., M.R.C.P. (Pp. xv + 480; illustrated. 84s.) Cambridge: The University Press. 1960.

In September 1958 a course was given in the Post-Graduate Medical School of the University of Cambridge designed mainly for dermatologists in clinical practice. This book is a record of these lectures and of the discussion which followed their presentation.

No attempt was made to provide a comprehensive review of the progress of the biological sciences in relation to dermatology but eleven subjects were selected for discussion and a number of eminent speakers presented papers on each topic. Several of these subjects have a much wider appeal than the title of the book would suggest e.g. "The melanocyte and melanogenesis", "Immunology" and "Carcinogenesis" and anyone interested in these subjects will find the papers both interesting and stimulating and in places the discussion will be found extremely helpful. Numerous references are given with each paper and this greatly adds to the value of the work.

The original papers were not intended to be published and Dr. Arthur Rook has done an invaluable service to dermatologists in collecting them together and presenting them in the form of a book. The book is well printed and the illustrations are good. The individual lectures are all well written and easy to read and understand.

Rose and Carless Manual of Surgery. Edited by Sir Cecil Wakeley, Bt., K.B.E., C.B., Michael Harmer and Selwyn Taylor. 19th edit. (Pp. xv + 1389; illustrated. 84s.) London: Baillière, Tindall & Cox. 1960.

So much of the attitude of the student to a subject is determined by textbooks that the appearance of this new and largely re-written edition of a classic in surgical textbooks is a major event. Though Sir Cecil Wakeley remains as Consulting Editor, there are two new Editors—Mr. Selwyn Taylor and Mr. Michael Harmer. They have called on fifteen other contributors, some naturally from King's but also from elsewhere; under the latter one notes the names of Murray Falconer, Alan Hunt, Rainsford Mowlem, Holmes Sellors, and A. B. Wallace. The Editors have been concerned to "keep the book of a reasonable size", and have reverted to one volume.

The arrangement is the traditional one of a preliminary section on general considerations—why the skin and the lymphatic system should come into this section is not clear—followed by sections on the various regions and specialties. The general sections indicate some of the modern physiological and biochemical approaches to surgery. Throughout, the work is authoritative, informative, up to date—it is a pleasure for example to find the ætiology of Hashimoto's thyroiditis given in a textbook—and attractively written and produced. All branches of surgery are covered; there are for example chapters on the eye, the ear, and the female genital organs. The chapters on fractures are such that the student will not need to read a separate book on this subject. On the negative side, a small amount of dead wood remains from previous editions, e.g. enteroptosis, infantile hernia, wire in the treatment of aneurysms, chronic interstitial mastitis. Again, in places there is an excess of classification, the result no doubt of the pathological desire of textbook authors for "completeness". Thus, we find included in the chapter on the breast such doubtful entities as "serous cysts" and "hydatid cysts"; and in the chapter on the mouth there is a vertiginous succession of headings like "catarrhal stomatitis", "aphthous stomatitis", "gangrenous stomatitis", "acute parenchymatous glossitis". The major questions also arise of whether a textbook of surgery for undergraduates should run to one thousand three hundred pages, and of whether it need contain technical details of operations. But, though the ideal textbook of surgery for undergraduates remains to be written and will possibly remain a dream, this new edition will rightly restore Rose and Carless to its old place among the leaders.

Atlas of Anatomy and Surgical Approaches in Orthopædic Surgery. Vol. 1: Upper Extremity. By Rodolfo Consentino, M.D. (Pp. xiv + 192. 84s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications Ltd. 1960.

This book is a series of photographs of anatomical dissections displaying all the important structures, and also those seen in the commoner surgical approaches to the upper limb. Great care has been taken to obtain optimum lighting and the photographs are almost uniformly excellent, with the added advantage of being approximately life size. As in the case of drawings, however, the clarity with which the structures are seen is to some extent deceptive from the very care and skill with which they have been cleaned. All are of cadaver specimens; in some instances photographs of actual opera-

tive exposures might have been more helpful. The use of colour photographs also, might have been advantageous in spite of the extra expense. However, the author has been eminently successful in his purpose of demonstrating "with accuracy the anatomical structures encountered by the operator from layer to layer" and this book can be recommended for rapid revision of anatomy before undertaking some unfamiliar approach.

Surgery and Clinical Pathology in the Tropics. By Charles Bowesman, O.B.E., B.A., M.D., F.R.C.S.E., F.A.C.S., D.T.M.&H.Ed. (Pp. viii + 1067; illustrated. £5 10s.) Edinburgh and London: E. & S. Livingstone Ltd. 1960.

There are many fascinating books written about Africa, the country, the people and the life they lead. Charles Bowesman has written of the working life of a surgeon in that great continent. This is the picture given by one who, having been well trained in his craft, is skilled in observation and practical in seeking a solution to his problems. The book gains by this approach for here we have no repetition from standard texts but the knowledge culled from long experience and careful thought.

The significance of malnutrition, malaria, anæmia and the helminthic infestations in modifying pathology, complicating diagnosis or jeopardizing surgical intervention, is well described. These basic conditions represent one of the most difficult aspects of surgical practice in the tropics. The author's approach to abdominal surgery is essentially personal and practical. In consequence it may be difficult to "look up" some particular point—although the index is excellent. The overall picture gains by this approach for the problem is presented as the general duty officer in smaller remote stations sees it.

Particular attention is paid to the practical surgical aspects of typhoid fever and amœbiasis and these sections are of special importance for their counterpart in standard textbooks is scanty and often secondhand.

The author rightly emphasizes the pathology and treatment of ano-rectal and genito-urinary diseases and the problems of ulceration, for these are lesions of major incidence in the tropics. The intending surgeon for a tropical clinic will note that obstetrics, ophthalmology, plastic, thoracic and orthopædic surgery will all fall to his lot.

The book is to be commended—it opens a new field, is readable and informative, and contains advice soundly based on experience. Above all it is practical and reliable, and to those who stay at home, here is something to read which will take them to a new world where snake bites, ritual operations and native enemata present surgical problems.

A Guide to the Identification of the Genera of Bacteria. By V. B. D. Skerman. (Pp. ix + 217; illustrated. 44s.) Baltimore: The Williams & Wilkins Company. London: Baillière, Tindall & Cox Ltd. 1959.

Dr. Skerman contributed the key for the determination of the generic position of organisms to the seventh edition of Bergey's Manual of Determinative Bacteriology, to which this book is intended as a supplement. It consists of three parts. The key is substantially the same as that which appeared in the Manual. The second section is titled Digest of Genera, and draws attention to deficiencies of descriptions within the genera. The third section—Methods—is an account of the techniques needed for the identification of bacteria. Some of those described are traditional, some have come from the author's laboratory and some have been extracted from the literature. Many pathologists may find this the most interesting section. There are 31 plates containing illustrations intended to assist in the interpretation of the key. The quality varies. Although costing 44s. and an obvious bench book, this is a paperback.

Henry E. Sigerist on the Sociology of Medicine. Edited by Milton I. Roemer, M.D. (Pp. xiii + 397. $6.75.) New York: MD Publications, Inc. 1960.

This book is a companion to a similar collection of Sigerist's essays, edited by Dr. Félix Martí-Ibáñez and reviewed in the *Proceedings* last month (**53**, 696). Its general purport is epitomized in the article entitled "The Physician and his Environment" in which are outlined the changes which have taken place in the attitude of society towards the sick man. "More and more," he says, "the concept prevails that health and disease are not the private concern of the individual, but that there exists a social obligation toward health."

Throughout the book, which deals with the doctor's work and position in all countries, both East and West, Sigerist's object is to show the gradually changing views of human society in regard to the real significance of illness. From his extensive knowledge of history he is able to give the reader a moving picture, beginning with the primitive notion of disease as a punishment for sin against the gods and the worship by the Greeks of health as the highest good; and ending with the increasing cult of preventive medicine as the ideal and the collective duty of citizens of a

modern welfare state. Like most philosophers, his conception of time is relative. The history of medicine is to him but a very short period (5,000 years) and he points out that medicine has only become really efficient in a matter of a century.

Like all this author's writings, these essays are original, forceful, and stimulating. We congratulate the Editor on his selection from Sigerist's numerous writings, and the publishers on the excellent print and the general format of the volume.

Harmful Effects of Ionizing Radiations. By Ethel Browning, M.D. (Pp. xii + 158. 15s.) Amsterdam, &c.: Elsevier Publishing Company. 1959.

This concise, sensible and readable book fulfils the need for a brief but, in essence, comprehensive book on the hazards and handling of ionizing radiation. Dr. Browning's unique experience of industrial hazards and her lucid style have combined to make it very valuable. It will be useful not only to medical officers, safety officers and laboratory workers, but to many others who wish to have concise information on this subject.

Non-specialist readers will appreciate the historical sections on the discovery and nature of X-rays and radioactivity, on general effects on living tissue, on units of radiation, and on maximum permissible dosages. Protective measures and regulations are usefully summarized. The final four chapters constitute the best part of the book; they describe radiation hazards clearly and in a well-balanced way under the headings "Acute and Subacute Effects", "Chronic and Delayed Effects", "Leukæmia", and "Genetics". Both non-specialist and non-medical readers will find these chapters extremely helpful. The sections on changes induced by radiation in the skin and in the blood picture of radiation workers is particularly good. The admirable brevity is offset by copious references.

A few small ambiguities of physics (e.g. on p. 3) and some untypical loss of clarity, due to compression (e.g. pp. 56 and 58), do not seriously detract from this book. On p. 82 it is not made clear that the similar skin effects mentioned for 2,000 r of β-radiation in fifty days and 500 r of X-rays (presumably in a single short treatment) are due to the different overall periods of exposure, and not to any difference in biological efficiency of X- and β-rays. Subjects which have not so far yielded firm evidence are wisely avoided. These include questions of recovery after exposure, and the possibilities of protection by marrow replacement. The final paragraphs of the book, however, constitute a brief, well-informed, and eminently sensible survey of the evidence of the shortening of life by irradiation.

Clinical Tropical Diseases. By A. R. D. Adams and B. G. Maegraith. 2nd edit. (Pp. x + 540; illustrated. 32s. 6d.) Oxford: Blackwell Scientific Publications. 1960.

The first edition of this handbook on tropical diseases was deservedly popular and the appearance of a second, seven years later, ensures the inclusion of recent valuable work. The arrangement in the second edition follows that of the old, the diseases conveniently in alphabetical order and discussed under systematic headings, so that the book is handy for quick reference. A rigid adherence to this method leads to some overlapping, and if the authors wish to save space they could probably leave out certain sections, as in "Onchocerciasis" where nodules and skin lesions are described under several headings. This would make room for certain diseases now omitted, such as the equine encephalitids, Kyasanur Forest disease, toxoplasmosis, &c., although many other cosmopolitan diseases are included such as leptospirosis and rat-bite fever. As a rule, there is no discussion of methods of control or of diagnosis as used in clinical pathology, but sometimes these are included as in epidemic dropsy and malaria respectively. Probably in a book of this size it would be preferable to omit these subjects entirely, but a uniform treatment is desirable.

There is no doubt that workers in tropical medicine will continue to find this new edition as useful and illuminating as the original.

Textbook of Otolaryngology. By David D. DeWeese, M.D., and William H. Saunders, M.D. (Pp. 464; 354 illustrations. 65s.) St. Louis: The C. V. Mosby Company. London: Henry Kimpton. 1960.

There are many good features in this students' textbook. The first thirty pages are occupied by a well-illustrated description of the physical examination of the region. This is well done; inevitably the differences between American and British practice emerge, but do not reduce the value of this section to British readers. The rest of the subject is dealt with regionally and each section is introduced by a good anatomical description of the organ under consideration. The illustrations generally are good and the laryngeal section is particularly well illustrated, use having been made of Holinger's excellent photographs illustrating the normal and abnormal appearances of the vocal cords.

Newer aspects of otolaryngology, such as audiometry, hearing aids and speech disorders, are described in an easily understood manner.

The physiology of the ear is discussed so that the function of the middle ear can be intelligently applied to the planning of surgical procedures on this organ. The difficult subject of the conversion of sound energy to nerve impulses and the localization of frequency in the organ of Corti is not mentioned.

Each chapter ends with suggestions for selected reading, though no references are included in the text. The selected reading is almost exclusively American, which might be considered somewhat insular. It is perhaps justified by the fact that the references are not primarily to original work but to symposia by recognized experts. There are chapters on the facial nerve, the salivary glands and cysts of the neck. These are not usual in otolaryngology textbooks, and are a useful addition.

On the whole this is a good textbook, so arranged that the information in it is easily found, and considering the quality of the illustrations and production it is not expensive.

Medical Surveys and Clinical Trials. Edited by L. J. Witts, C.B.E., M.A., M.D., Sc.D., F.R.C.P. (Pp. x+328; 17 illustrations. 35s.) London: Oxford University Press. 1959.

This book is evidence of the growing interest of clinical workers in the study of factors that influence the occurrence of disease in population groups. It is the work of eighteen writers all experienced in this type of research and many also prominent in clinical medicine. The book is primarily intended for clinical research workers both in hospital and general practice, but it should prove useful to students of public health and could be read with advantage by medical undergraduates.

The contents are presented in two parts of almost equal length, the first dealing with the methodology of field surveys and trials and the second with the application of these methods in certain fields of medicine to-day. Such is the swing in the pendulum of fashion that microbiological aspects of disease are scarcely mentioned. This is a pity if only because it is in this field that collaboration between laboratory and clinical workers—increasingly important in epidemiological studies—is best exemplified.

In presenting survey and trial methods as a simple extension of clinical medicine, Professor Witts has perhaps failed to give sufficient emphasis to the principles that underlie the study of disease as an ecological problem. The methods of epidemiology are straightforward but the reasons for using them are less understood; more attention to why and less detail on how might have been an advantage.

The Discovery of Reflexes. By E. G. T. Liddell, D.M., F.R.S. (Pp. vi+174; illustrated. 30s.) London: Oxford University Press. 1960.

Professor Liddell has set out to recapture the scientific and philosophical atmosphere in which Sherrington began his work. He reviews the state of knowledge and technique from early times, but chiefly in the one hundred years before Sherrington. The book is in four sections: the first considers the methods used by the anatomists in their investigations of the minute structure of the nervous system. The second section concerns animal electricity and the attempts to link the phenomena, recorded with the relatively slow and insensitive instruments available, to the knowledge of nervous transmission. The third section deals with the knowledge gained from the application of experimental techniques to whole animals and to man. The last section describes the climate of opinion in which Sherrington grew up academically.

This book will engender a very healthy respect for the achievements of the workers of the period with the limited means at their disposal. At the same time the reader will appreciate more fully the magnitude of the advance made by Sherrington in building on these foundations the structure of knowledge about reflex activity which has been the basis of virtually all work in this field since. As would be expected from this author the book is written in a way which makes it a pleasure to read and it is presented by the Clarendon Press in a style worthy of its contents.

An Introduction to Congenital Heart Disease. By Leo Schamroth, M.B., B.Ch.(Rand), M.R.C.P.E., F.R.F.P.S., and Fay Segal, M.D.(Rand). (Pp. ix+116; illustrated. 22s. 6d.) Oxford: Blackwell Scientific Publications. 1960.

This book is designed to provide, for the medical student and practitioner, a brief account of the enormous amount of new knowledge that has been obtained in the field of congenital heart disease in recent years. It succeeds in this aim, and should prove valuable. Owing to the size of the book in relation to the size and complexity of the subject, much of the presentation is, of necessity, somewhat didactic. The illustrations are mostly clear and well produced, although some of those representing the mixture of arterial and venous blood in various shunts could perhaps be improved. For the doctor who might wish to pursue certain aspects of the subject considerably further than this book will take him, it is a pity that a fuller bibliography has not been supplied.

World Review of Nutrition and Dietetics. Vol. 1. Edited by Geoffrey H. Bourne. (Pp. viii+272; illustrated. 60s.) London: Pitman Medical Publishing Co. Ltd. 1959.

This is the first volume of a promised annual series of publications designed to overcome the confusion created by "the avalanche of published papers" dealing with nutrition. One aim of the editor is to provide "more lengthy and discursive reviews than are published in conventional journals". In this he has certainly succeeded. The volume comprises ten chapters, contributed from five countries, each reviewing a different specialized field with little relation to the others. Though undoubtedly a useful reference book for workers in these selected fields, the book hardly gives a balanced view for the general reader; too often, as the editor had apparently hoped, a chapter bears "the imprint of the author himself". Consequently there are some curious omissions. For instance, the chapter dealing with the history of nutrition makes no mention of Peters' classic work on thiamine; the chapter on kwashiorkor gives only a passing reference to Cicely Williams who first described the disease; while the chapter on vitamin B_{12} hardly mentions the basic British work on this vitamin. If this is to be a truly international publication, why are the two chapters contributed from France not printed in the original French? Indifferent translations are a poor substitute.

In sum, the title of the book may seem somewhat pretentious. The printing is in double columns and in small type, which does not lend itself to easy reading. Some of the figures (e.g. that on p. 133) are illegible.

Nevertheless this book may serve a useful purpose in drawing attention to the widening international gulfs developing in the science of nutrition, and even in specialized branches of it.

Gastric Cytology. Principles, Methods and Results. By Rudolf Otto Karl Schade, M.D.(Dunelm), M.D.(Tübingen), L.R.C.P., M.R.C.S. (Pp. viii+83; illustrated. 35s.) London: Edward Arnold (Publishers) Ltd. 1960.

Exfoliative cytology in the diagnosis of gastric carcinoma has been studied to a considerable extent in recent years. Various methods have been employed to obtain preparations for critical examination and various instruments have been introduced such as the gastric balloon by Panico, Papanicolaou and Cooper and the gastric brush by Ayre and Owen. The author, however, prefers the simple lavage technique as used at the Vincent Memorial Hospital. With this technique and the staining method of Papanicolaou Schade claims considerable success as shown by an accuracy of 97·6% in 252 cases subsequently proved to be malignant. In 251 non-malignant conditions such as peptic ulceration 94·8% were cytologically negative. There were 6 false negatives in the first group and 13 false positives in the second. The majority of other workers have been much less successful in the detection of gastric carcinoma. Of great interest is the fact that 10·5% of the cancer cases were undiagnosed by radiology and amongst those were 16 cases of surface carcinoma unsuspected clinically. The detection of carcinoma at this early stage is obviously an important advance in diagnosis. The book is well illustrated and shows the various types of cells, innocent and malignant, found in gastric washings. There are numerous references many of which are of Teutonic origin. The book should be valuable to those interested in cytology.

Proceedings of a Symposium on Immunization in Childhood. (Pp. 139; illustrated. 17s. 6d.) Edinburgh and London: E. & S. Livingstone Ltd. 1960.

This Symposium, held in London in May 1959, was attended by many experts from Great Britain and some from other parts of the world. The main papers are given in full and the subsequent discussion in fair detail. The first session was devoted to the dangers of immunization especially that of provocation poliomyelitis which at present overshadows all inoculation schedules for children. The hazards to the nervous system of pertussis vaccination and problems of sterilizing syringes and needles were dealt with more briefly. In the second and third sessions the present status of immunization against poliomyelitis, pertussis, diphtheria and tetanus was examined. This was followed by consideration of the advantages and difficulties of combining these prophylactics and a short review of ways in which records of immunization, particularly against tetanus, should be kept. The fourth and fifth sessions were devoted to discussion of various immunization programmes leading to agreement by the Symposium upon certain recommendations set out in detail in the Appendix. These recommendations, published in the *British Medical Journal* shortly after the conference, include two alternative schedules—one allowing the use of a combined diphtheria-pertussis vaccine and the other employing only single antigens. This book should be valuable to doctors working in public health and of interest to many in general practice. Those who were unable to attend the meeting could not wish for a better account of the proceedings for, though much has been summarized, humour and personality have been admirably preserved. The

format is simple and inexpensive as befits a work which, though authoritative, will rapidly become outdated.

Microchemical Methods for Blood Analysis. By Wendell T. Caraway, Ph.D. (Pp. xi + 109. 42s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1960.

This manual will be welcome in many laboratories. The author has modified standard biochemical procedures for use on small volumes of serum, only 20 to 100 microlitres being required for each test. These methods should be of great value in pædiatric units and in studies on small animals and will increase the number of routine tests which can be done on samples of capillary blood. The book has a detailed section on general technique including the calibration of micropipettes, the collection of capillary blood and separation of serum, and a short discussion of quality control. The methods are presented in considerable detail. A special feature of the book is the inclusion of notes on each method which describe the preparation of calibration curves and some of the technical difficulties which may be encountered. Standard laboratory equipment is used, and no special expensive apparatus is needed. Only the more common blood constituents are dealt with and methods for cerebrospinal fluid and urine are included where the blood methods are applicable.

Clear directions and good type make these methods look easy, but considerable experience will be necessary before they can replace the standard micro-analytical techniques.

Diseases of the Skin. By James Marshall, M.D. (Lond.). (Pp. viii + 944; illustrated. 84s.) Edinburgh and London: E. & S. Livingstone Ltd. 1960.

James Marshall has produced a very satisfactory textbook of dermatology. It is designed as a reference book for undergraduates and general practitioners and the author believes it may serve as introductory reading for postgraduate students. It is certainly too long for the average student to read and it is unlikely that he could afford to buy it as a book of reference. Its main use may well be in providing introductory reading for postgraduate students as it is fairly comprehensive and the descriptions are concise and clear. The book is well illustrated; most of the photographs are good but a few, such as Fig. 81, are not so helpful.

The system of classification used is largely orthodox, diseases of unknown or doubtful ætiology being grouped according to their physical signs; where the ætiology is known, as with the infections, diseases are grouped according to the type of organism responsible. In the case of viruses this brings together some strange bedfellows: thus we find smallpox, warts and lymphogranuloma venereum all considered in the same chapter.

Treatment is also orthodox and the forthright condemnation of the local use of antihistamines is welcome. The suggestion that D.D.T. may be incorporated in calamine lotion to prevent offending parents of children suffering from papular urticaria is an amusing and useful hint. The arrival of griseofulvin during the preparation of the book must have caused many last minute alterations as it is frequently mentioned in connexion with fungus infections.

Electrophoresis in Physiology. By Lena A. Lewis, Ph.D., LL.D. 2nd edit. (American Lecture Series No. 385. Pp. v + 120; illustrated. 44s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1960.

In a work of this size only a general outline of the subject could be attempted and consequently care is necessary in selecting the topics to be given such emphasis as is possible. This book, which attempts at the same time to be a general review and a detailed practical manual inevitably fails to be either.

The first part is a description of apparatus with emphasis on the fundamental Tiselius equipment. There is a very brief account of zone electrophoresis, while the figure illustrating scanning is rendered misleading by typographical error.

The second part is a survey of the results obtained in pathology and general physiology. There are some notable omissions and some unexpected inclusions. This is, however, the most successful part of the book and, without being comprehensive, covers the field. A chapter on immuno-electrophoresis conveys a rather misleading impression. The most successful and widely used methods are almost ignored and there are several disputable statements.

A final section on the technique of Tiselius, paper and "starch-gel immuno"-electrophoresis seems out of place in a book of this kind. There is more detail than the general reader would require but insufficient for those who actually intend to perform an experiment. The bibliography is adequate up to 1955.

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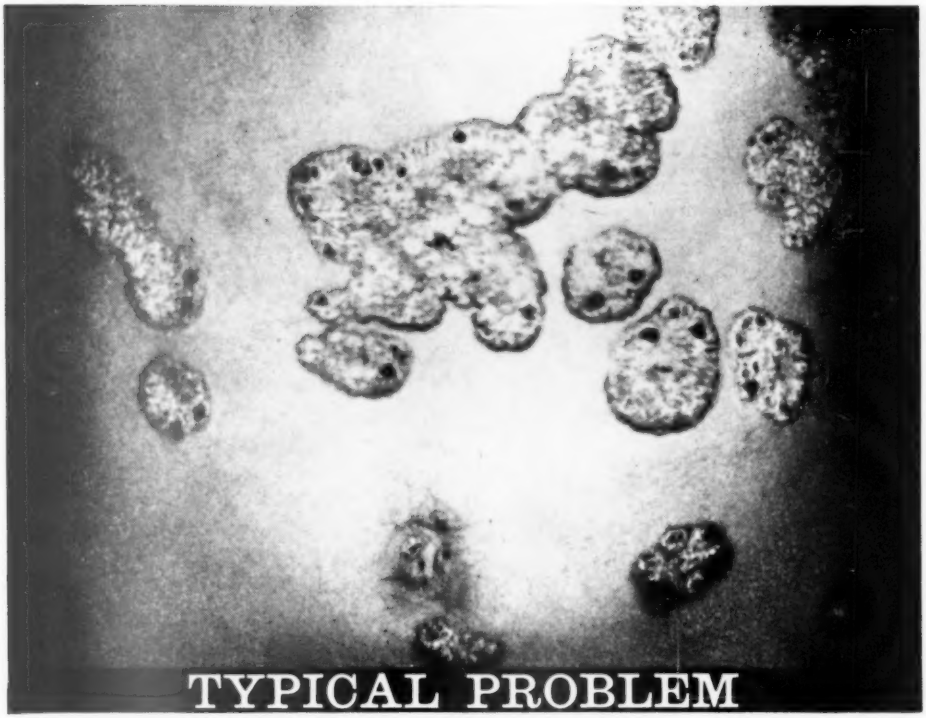

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